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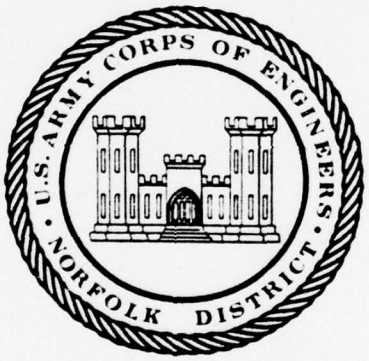
JAMES RIVER BASIN

LEVEL II

Name of Dam: Johns Creek No. 4
Location: Craig County, State of Virginia
Inventory Number: VA 04504

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



DACW-65-78-D-0016

PREPARED FOR
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

PREPARED BY
MICHAEL BAKER, JR., INC.
BEAVER, PENNSYLVANIA 15009

AUGUST 1979

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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Appendices

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Johns Creek No. 4
State: Virginia
County: Craig
Stream: Dicks Creek
USGS 7.5 Minute Quadrangle: Waiteville, VA-W.VA
Date of Inspection: 9 May 1979

BRIEF ASSESSMENT OF DAM

Johns Creek No. 4 Dam is a zoned, earthfill dam approximately 850 feet long and 55 feet high. The dam, located approximately 18 miles southwest of New Castle, Virginia, is used for flood control. Johns Creek No. 4 Dam is an "intermediate" size - "significant" hazard structure as defined by the Recommended Guidelines for Safety Inspection of Dams. Visual inspection and office analyses indicate no deficiencies requiring emergency attention.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 1/2 Probable Maximum Flood (1/2 PMF) was selected as the spillway design flood (SDF). The SDF was routed through the reservoir and found to overtop the dam by a maximum depth of 1.4 feet with an average critical velocity of 3.1 f.p.s. Total duration of dam overtopping would be approximately 3.2 hours. The spillway is capable of only passing approximately 25 percent of the PMF and is therefore adjudged as inadequate.

No conditions indicating embankment instability were detected during the field inspection and office analyses. The safety factors determined during design are greater than those required for minimum accepted stability. The dam and appurtenant structures were found to be in generally good overall condition. Seepage at the toe of the dam is not considered serious; however, it is recommended that the seepage rate be checked for an increase at higher reservoir levels.

The following repair items should be accomplished as part of the general maintenance of the dam: remove brush and small trees from the outlet area and the embankments, seed the wave erosion area on the upstream embankment, remove debris from the embankment slope, and install a staff gage in the reservoir.

MICHAEL BAKER, JR., INC.

Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

COMMONWEALTH OF VIRGINIA
MICHAEL
BAKER III
NO. 3176
CERTIFIED PROFESSIONAL ENGINEER

SUBMITTED: Original
JAMES A. WALSH

James A. Walsh
Chief, Design Branch

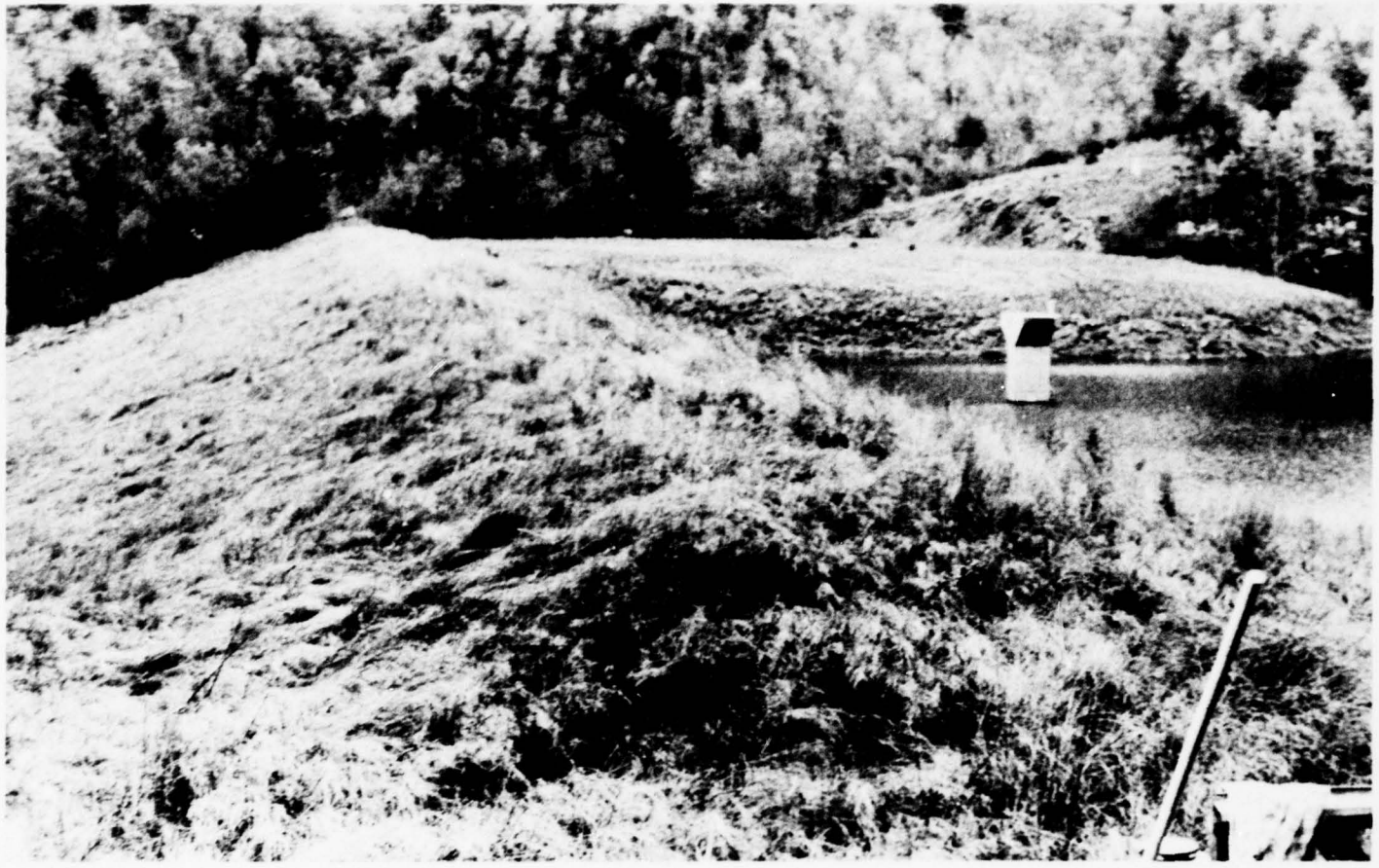
RECOMMENDED: ORIGINAL SIGNED BY:
CARL S. ANDERSON, JR.
for Jack G. Starr
Chief, Engineering

APPROVED: Original signed by:
Douglas L. Haller

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: AUG 29 1979

NAME OF DAM: JOHNS CREEK No. 4



OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: JOHNS CREEK No. 4 ID# VA 04504

SECTION 1 - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: Johns Creek No. 4 Dam is a zoned, earthfill embankment approximately 55 feet high[1] and 850 feet long. The upstream and downstream slopes are 2.5:1 (horizontal to vertical) and the crest width is 18 feet. A 10 foot berm is provided on the upstream embankment at elevation 1863.0 feet Mean Sea Level (M.S.L.), with a 3:1 slope below the berm. Seepage control is provided by an impervious core, a cut-off trench, and seepage drains. The seepage drains to the left[2] and right[2] of the impact basin lie along the toe of the dam and consist of filter material and perforated 6 inch bituminous coated corrugated metal pipe. Both drains exit into the impact basin through the side walls.

The principal spillway is a drop-inlet structure consisting of a reinforced concrete riser which is 2.5 feet wide, 7.5 feet long, and

[1]Measured from downstream embankment toe to the embankment crest.
[2]Facing downstream.

37 feet high. A 30 inch reinforced concrete outlet pipe discharges into an impact basin approximately 280 feet from the riser at the downstream toe of the embankment.

The 250 foot wide, vegetated, earth side channel emergency spillway is located outside the right abutment of the dam. The approach channel has an adverse slope of approximately 2 percent to the 30 foot long level control section. The discharge slope of the emergency spillway channel is approximately 3 percent.

The riser is a two-stage drop-inlet type. A secondary level orifice-inlet located on the right side of the riser is 12 inches by 18 inches and has an invert elevation of 1862.3 feet M.S.L. The high stage inlet has an invert elevation of 1882.3 feet M.S.L. A 24 inch pond drain with a manually operated sluice gate is provided at the bottom of the riser (invert elevation 1843.08 feet M.S.L.). The plan and typical sections of the dam are shown on Plates 2, 4, and 5.

1.2.2 Location: Johns Creek No. 4 Dam is located on Dicks Creek approximately 18 miles southwest of New Castle, Craig County, Virginia. A Location Plan is included in this report.

1.2.3 Size Classification: The maximum height of the dam is 55 feet; the reservoir storage capacity to the top of dam elevation 1897.2 feet M.S.L. is 1022 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.2.4 Hazard Classification: The dam is in a rural area where failure may damage several homes located approximately 2000 feet downstream and several other homes located further downstream. Several farm buildings are located approximately 1 mile downstream of the dam and loss of livestock and damage to farmland are likely in the event of failure of the dam. Therefore, this dam is considered in the "significant" hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability failure.

1.2.5 Ownership: The dam is owned by Mr. A. G. St. Clair, 223 Church Street, Tazewell, Virginia 24651.

1.2.6 Purpose of Dam: The dam is used for flood control within the James River Basin.

1.2.7 Design and Construction History: The existing facility was designed by the U.S. Department of Agriculture, Soil Conservation Service (SCS). The dam, completed in 1966, was built by Curtis Horton Contractors, Inc.

1.2.8 Normal Operational Procedures: The reservoir is maintained at normal pool elevation of 1862.3 feet M.S.L. No formal operating procedures are followed for the dam. For a more detailed operating assessment, see paragraph 4.1.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area for Johns Creek No. 4 Dam is 5.63 square miles.

1.3.2 Discharge at Dam Site: The maximum discharge at the dam site is unknown.

Principal Spillway:
Pool level at top of dam . . 135 c.f.s.

Emergency Spillway:
Pool level at top of dam . . 6100 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Reservoir Area acres	Reservoir Capacity Acre-feet	Reservoir Capacity Watershed inches	Length feet
Top of dam	1897.2	46.5	1022	3.40	4400
Emergency spillway crest	1892.9	39.5	834	2.77	4000
Principal spillway crest	1882.3	29.3	465	1.55	3200
Secondary level orifice invert (normal pool)	1862.3	12.0	65	0.21	1700
Streambed at downstream toe of dam	1842±	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The site was investigated and the embankment designed by the SCS. Incomplete SCS reports of the field investigation and stability analyses are presented in Appendix VII and VI, respectively.

The zoned embankment was constructed on alluvial, colluvial, and residual silty sands (SM) which varied in thickness between approximately 1 foot and 14.5 feet along the dam centerline. These soils are underlain by the steeply dipping Millboro Shale which contains a seam of impure anthracite coal of unspecified thickness.

The test pit logs indicate that silty sand (SM) soils were the predominant material from borrow sources for embankment construction. Shale and silty sand (SM) were obtained from the emergency spillway excavation. According to the as-built typical section shown on Plate 5, the embankment was constructed of 4 zones. Section 1, the center cover and the cut-off trench backfill, was constructed of silt and clay (ML and CL). Section 2, the upstream segment and the shell section, was built of silty and clayey sand (SC-SM). Section 3, located between the center and downstream sections, was constructed of silty sand (SM) soil. The downstream section (Section 4) was constructed of shale, which was designed based on a minimum mass density of 122 p.s.f.

The upstream slope was constructed at ratios of 2.5:1 over 3:1 with a 12.5 foot wide berm at elevation 1863.0 feet M.S.L., the slope ratio break point. The downstream slope was built at a uniform 2.5:1 ratio.

A 6 inch diameter, bituminous coated, perforated metal pipe foundation underdrain system was installed beneath the downstream embankment section.

A 14 foot wide cut-off trench of variable depth was excavated beneath the centerline of the embankment.

Because all the laboratory and stability analysis data were not provided, complete evaluation of the design cannot be made.

The slope stability analyses given in Appendix VI is incomplete in that the zoning of the various soils used in the analysis are unknown and no analysis of downstream slope stability is given. However, the following saturated shear strength parameters were used based on laboratory test data. The type of tests used for obtaining these parameters is not known.

	Percent Maximum Standard Density	Ø	c(p.s.f.)
Foundation (SC)	--	25.5°	325
Embankment (SC-SM)	95	25.5°	150
Embankment (SC-SM)	98	28.0°	550
Embankment (Shale)	95	39.0°	450

The upstream slope configuration studied in this analysis is similar to the as-built design. The analysis was made for a full drawdown condition, using the Swedish Circle Method. The minimum safety factor was only 0.92 at 95 percent maximum density. At 98 percent compaction, the minimum safety factor was an acceptable 1.61.

Apparently, other analyses were completed but not available for review by Michael Baker, Jr., Inc. The text of the design report, page VI-1 of Appendix VI, indicates the following minimum safety factors for embankment placement at 98 percent maximum standard density with Ø = 28° and c = 550 p.s.f. for a slope configuration similar to the as-built typical but with no specified zoning:

Upstream slope: 1.35
Downstream slope: 1.57 (with foundation drain)

Although no settlement calculations were available, it was recommended in the SCS design report that a 2.0 foot overfill be placed between Stations 5+50 and 8+00 to provide for approximately 1.5 foot settlement of the embankment and approximately 0.5 feet of the foundation.

The emergency spillway channel required no special treatment.

2.2 Construction: The dam, constructed by Curtis Horton Contractors, Inc., was completed in 1966. Construction records were not available for this inspection; however, as-built drawings were reviewed and were subsequently verified in the field. Construction reports are on file in Washington, District of Columbia.

2.3 Operation: There are no formal operating procedures for this dam. The previous maximum discharge at the site is unknown. For a more detailed operating assessment, see paragraph 4.1.

2.4 Evaluation

2.4.1 Design: The as-built drawings and design report were available to assess all aspects of design except for embankment stability as noted above. The hydrologic and hydraulic data provided was adequate for design review. The assessments made in this report are based on available design data along with field observations.

2.4.2 Construction: No construction records were available for review. The as-built drawings indicate changes or modifications that were made during the construction.

2.4.3 Operation: Annual operation and maintenance inspection reports were available for review (see Appendix V).

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: When the field inspection was made on 9 May 1979, the reservoir was at normal pool elevation; the weather was partly cloudy with temperatures in the mid-70's F. and ground conditions were dry. The dam and appurtenant structures were generally in good condition. The only problems found are considered to be relatively minor--erosion in the emergency spillway area and on the upstream embankment face (see Photos 1 and 5). Plate 1 is a Field Sketch of conditions found at the time of the inspection. The complete visual inspection check list is found in Appendix III. The following are brief summaries of conditions found during the inspection.

3.1.2 Dam: No cracks, slumps, bulges, or other indications of surface movement or embankment distress were noted. The downstream toe of the embankment on both sides of the outlet works contained some clear seepage, as did the plowed field to the right of the downstream channel (see Photo 8). This condition is not believed to indicate any potential stability problems. Since the reservoir was at normal pool during the inspection (and therefore the hydraulic head was low), it is recommended that the seepage be checked when the reservoir level is higher to determine any significant increase in the rate of seepage. There has been some minimal wave erosion of the upstream embankment face below the previous high waterline (see Photo 1). Other than this area, no major evidences of erosion were found on the embankment. The steep slope of the disposal area for rock excavated from the emergency spillway contains slabs of shale which are decomposing into splintery fragments and falling at a relatively slow rate into the reservoir (see Photo 5). The shale cut slope on the right of the emergency spillway is also deteriorating, resulting in an accumulation of talus in the emergency spillway (see Photo 6). There are a few small trees (generally less than 2 inches in diameter) on the embankment which should be removed.

3.1.3 Appurtenant Structures: No apparent structural deficiencies were found during the inspection.

3.1.4 Reservoir Area: No apparent unstable areas were noted in the reservoir area. The area upstream from the disposal area is moderately sloped and heavily wooded. The slope on the left is relatively flat and appears to be stable although there are some wet areas (see Photo 7).

3.1.5 Downstream Channel: The area around the outlet structure and the upper portion of the downstream channel contains a dense growth of small trees, generally less than 2 inches in diameter, and brush which should be removed (see Photo 3). Otherwise, the downstream channel is unobstructed and the outlet works are in good condition.

3.2 Evaluation: The dam and appurtenant were generally in good condition. The deficiencies on this dam are the brush and small trees which should be removed from the area of the outlet works and from scattered locations on the embankment. The shale debris which is forming from the rock in the disposal area and from the shale bedrock in the emergency spillway cut slope poses no problem to the proper functioning of the dam. It is doubtful if a well developed vegetative growth can be established in these areas. Although the small amounts of wave erosion occurring on the upstream embankment face pose no threat to the stability of the dam, it is recommended that the area be seeded with water tolerant plants as part of general maintenance. In addition, the debris along the upstream embankment slope should be removed.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: There are no formal operating procedures for Johns Creek No. 4 Dam. The reservoir level is maintained by the secondary level orifice inlet located on the right side of the riser.

During periods of heavy inflow, the excess water is diverted around the dam by means of the emergency spillway. A berm was constructed between the embankment and spillway to protect the downstream toe from erosion caused by flow through the emergency channel. This berm, which is approximately 200 feet long, directs the flow through the emergency spillway channel to a point below the dam where it enters the downstream channel.

4.2 Maintenance of Dam: The Natural Bridge Soil and Water Conservation District personnel along with local SCS representatives perform an annual inspection of the dam. Maintenance of the dam is provided by the Natural Bridge Soil and Water Conservation District.

4.3 Maintenance of Operating Facilities: The Natural Bridge Soil and Water Conservation District provides maintenance of the operating equipment.

4.4 Warning System At the present time, there is no formal warning system or evacuation plan in operation.

4.5 Evaluation: Maintenance of the dam is considered adequate.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 Design: Normal pool (elevation 1862.3 feet M.S.L.) is maintained by the 12 inch by 18 inch secondary level orifice-inlet on the right face of the concrete riser. The orifice invert was established at the elevation sufficient to store the 50-year sediment accumulation. The riser crest elevation (1882.3 feet M.S.L.) was established at the minimum elevation to store an additional 1.2 inches of runoff above normal pool. The capacity (120 c.f.s. with the reservoir level at the emergency spillway crest) of the principal spillway was established by consideration of a number of factors including:

1) The capability of evacuating the flood storage space within a resonable time (less than 10 days).

2) Not passing damaging floods downstream.

3) The capability of the reservoir to store the floodwater.

The crest (elevation 1892.9 feet M.S.L.) of the emergency spillway was established at the elevation needed to store the 50-year flood. The elevation of the top of dam (1897.2 feet M.S.L.) was established by use of the freeboard hydrograph. The freeboard hydrograph was developed for a class "b" structure and was obtained by utilizing a 6-hour rainfall of 14.1 inches producing a storm rainfall of 10.16 inches.

5.2 Hydrologic Records: No rainfall or stream flow records were available at the dam site.

5.3 Flood Experience: No exact high water marks were available. However, it is apparent from the previous high water line along the face of the dam that water in the reservoir has reached an elevation of at least 1882.3 feet M.S.L. in the past.

5.4 Flood Potential: The Probable Maximum Flood (PMF) and 1/2 Probable Maximum Flood (1/2 PMF) were developed and routed through the reservoir by use of the HEC-1 DB computer program (Reference 9, Appendix VIII) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's T_c and R coefficients for the local drainage areas were estimated from basin characteristics. The rainfall applied to develop the unit hydrograph was obtained from the U.S. Weather Bureau's publication (References 5 and 16, Appendix VIII). The

inflow hydrograph for the PMF was developed by the Corps of Engineers using a rainfall of 33.4 inches in 24 hours producing a runoff of 31.7 inches. Losses were estimated at an initial loss of 1.0 inch and a constant loss thereafter of 0.05 inch per hour.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, paragraph 1.3.3.

Regulation of flow from the reservoir is automatic. Normal flows are maintained by the secondary level orifice-inlet in the riser with an invert elevation of 1862.3 feet M.S.L. and the crest of the riser with an elevation of 1882.3 feet M.S.L. Water entering the inlets flows through the dam in a 30 inch diameter reinforced concrete conduit. Water also flows past the dam through the ungated, vegetated, emergency spillway in the event water in the reservoir rises above an elevation of 1892.9 feet M.S.L.

Outlet discharge capacity, and reservoir area and storage capacity were taken from the SCS Design Report. Hydrograph data and routing computations for PMF and 1/2 PMF were computed as part of this report. The flood routings were begun with the reservoir level at normal pool.

5.6 Overtopping Potential: The probable rise of the reservoir and other pertinent information on reservoir performance are shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrographs 1/2 PMF	Hydrographs PMF(a)
Peak flow, c.f.s.			
Inflow	6	14,085	28,170
Outflow	6	14,029	28,105
Peak elev., ft. M.S.L.	1862.3	1898.6	1900.3
Emergency spillway(b) (elev. 1892.9 feet M.S.L.)			
Depth of flow, ft.	-		
Average velocity, f.p.s.	-	3.8	4.9
Duration of flow, hrs.	-	11.1	12.6
Non-overflow section (elev. 1897.2 ft. M.S.L.)			
Depth of flow, ft.	-	1.4	3.1
Average velocity, f.p.s.	-	3.1	4.7
Total duration of overtopping, hrs.	-	3.2	5.2
Tailwater elev., ft. M.S.L.	1842.5(c)	-	-

(a) The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in a region.
(b) Depth and velocity estimates were based on critical depth at control section.
(c) Tailwater at time of inspection.

5.7 Reservoir Emptying Potential: A 24 inch sluice gate on the upstream face of the riser is available to dewater the reservoir. According to the SCS Design Report, the time for the reservoir level to decrease from the emergency spillway crest (elevation 1892.9 feet M.S.L.) to the riser crest (elevation 1882.3 feet M.S.L.) is approximately 2 days. From this level, it would take approximately 13 days to return to the secondary level orifice invert (elevation 1862.3 feet M.S.L.) The reservoir drawdowns, as determined by the SCS, were computed neglecting inflow.

5.8 Evaluation: Johns Creek No. 4 Dam is an "intermediate" size-"significant" hazard dam requiring evaluation for a spillway design flood (SDF) equal to the 1/2 PMF. The 1/2 PMF was routed through the reservoir and found to overtop the dam by a maximum depth of approximately 1.4 feet with an average critical velocity of 3.1 f.p.s. Total duration of dam overtopping would be approximately 3.2 hours. The spillway is capable of passing only 25 percent of the PMF.

Conclusions pertain to present day conditions and the effect of future development on the hydrology has not been considered.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: Boring and test pit information shown on the as-built drawings and available geologic and laboratory reports were used in combination with field observations to determine foundation conditions at the dam site.

Bedrock beneath the dam is primarily the Lower Devonian, Lower Millboro shale, which is described as steeply dipping, carbonaceous, black, fissile and containing a seam of impure anthracite coal of unknown thickness. The foundation soil cover along the centerline of the dam varies in thickness from approximately 1 foot to greater than 14.5 feet and consists mainly of alluvial, colluvial, and residual soils which were classified as silty sand (SM). Portions of the soil mantle below the SM cover contain boulders and cobbles. The as-built sections show that the embankment was constructed on these foundation soils, with only the cut-off trench extending to bedrock.

The soils in the left abutment are mainly colluvial, whereas those on the right abutment are residual, thinly overlying shale bedrock. Shale is presently exposed in the deep cut slope of the emergency spillway.

A 14 foot wide cut-off trench of variable depth was excavated along the centerline of the embankment. A foundation drain, consisting of 6 inch diameter bituminous coated metal pipe, was placed beneath the downstream embankment slope.

6.2 Stability Analysis

6.2.1 Visual Observations: No tension cracks, bulging, or other evidence of movement were noted anywhere on the embankment or beyond the toe. Some clear seepage (too small to measure) is occurring at the downstream toe area as discussed in paragraph 3.1.2.

6.2.2 Design Data: As a result of its analyses, the SCS recommended that the zoned embankment be compacted to 98 percent maximum standard desnity to the following slope configuration, with a cut-off trench to firm bedrock across the floodplain:

Upstream: 2.5:1 over 3:1 with a 13 foot berm at elevation 1863.0 feet M.S.L.

Downstream: 2.5:1 with a drain at c/b = 0.6.

The SCS design report also recommended that the more plastic CL and ML soils be used in the (trench) backfill and center section, with SM or GM material in the downstream section above the phreatic line, if possible. Two feet of overfill was recommended to compensate for 1.5 feet of settlement in the fill and 0.5 feet in the foundation.

The typical Section of Compacted Fill shown in the construction drawings indicates that the slope configuration was essentially the same as that recommended. The section shows the zoning also to be similar, with the following configuration:

Section 1: The center core and cut-off trench backfill were built of compacted silt and clay (ML and CL).

Section 2: The upstream section and shell were constructed of compacted silty and clayey sand (SC-SM).

Section 3: This section is located between the center and downstream sections and constructed of compacted silty sand (SM).

Section 4: Shale was used entirely for construction of this downstream section.

The SCS used the Swedish Circle Method for analyzing dam stability. Although all of the test data and analyses information were not available for review, the information presented in Appendix VI is the analyses of an embankment compacted to 95 percent and 98 percent of maximum standard density. The following parameters used in the analyses are based on laboratory tests. Information explaining the type(s) of tests used to obtain this data was not provided.

	Percent Maximum Standard Density	ϕ	c(p.s.f.)
Foundation (SC)	-	25.5°	325
Embankment (SC-SM)	95	25.5°	150
Embankment (SC-SM)	98	28.0°	550
Embankment (Shale)	95	39.0°	450

Only the upstream slope configuration was analyzed and no cross section was given to indicate zoning. However, the slope and berm configuration are similar to the as-built design. For a full drawdown condition, using saturated shear valves, the minimum safety factors were 0.92 at 95 percent compaction and 1.61 at 98 percent compaction.

However, other analyses were apparently made. The design report indicates the following safety factors for an analysis using an embankment shear strength of $\emptyset = 28°$ and c = 550 p.s.f. at 98 percent embankment compaction, for a section across the floodplain. No other information was available.

Upstream: On the 2.5:1 over 3:1 slope with 13 foot berm and slope change at elevation 1863.0 feet M.S.L., the safety factor was 1.35.

Downstream: For a 2.5:1 slope with drain, the safety factor was 1.57.

6.2.3 Operating Records: The available SCS operation and maintenance inspection reports since January 1975 indicate that a problem with a slow drawdown was effectively corrected in 1975 by the SCS by revising the first stage opening. The 1975 inspection report indicates that the relatively small size of the first stage opening resulted in water standing over much of the temporary storage area too long during wet periods; no vegetative cover could be maintained. Otherwise, no problems with dam stability were found. Operation and maintenance inspection reports are provided in Appendix V.

6.2.4 Post-Construction Changes: The only known post-construction change was the revision to the first stage opening previously discussed.

6.2.5 Seismic Stability: Johns Creek No. 4 Dam is located in Seismic Zone 2 and is considered to have no hazard from earthquakes, according to the text of Recommended Guidelines for Safety Inspection of Dams, provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: Although the as-built zoning of the embankment may vary from that analyzed by the SCS (design information is incomplete), the embankment design appears adequate. No evidence of embankment instability was observed during the field inspection and no indications of unstable conditions have been recorded in the inspection reports. The safety factors given in the design report meet the minimum acceptable safety factors.

Although the clear seepage at the toe of the embankment did not appear to be significant at the time of inspection, additional inspections should be made periodically during periods of high reservoir levels to determine changes in the rate of seepage or the appearance of muddy water. Should adverse changes be found, further investigation into embankment stability should be made.

Based on the field inspection and records of past inspections, it appears that the embankment is stable and the design adequate.

The left cut slope of the emergency spillway separates the spillway from the right side of the downstream embankment slope. The cut is through soil and weathered shale and is provided only with vegetative growth for erosion protection. This slope would serve to divert water from the embankment during periods of high flow through the emergency spillway. Riprap protection of this slope would prevent erosion during periods of high flow.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The dam and appurtenant structures are generally in good overall condition. No deficiencies were discovered during the field inspection and office analysis which would indicate the need for emergency attention. Riprap on the slope of the berm on the left side of the emergency spillway would prevent erosion during high flows.

Using the Corps of Engineers' screening criteria for initial review of spillway adequacy, the 1/2 PMF was selected as the SDF for the "intermediate" size-"significant" hazard classification of Johns Creek No. 4 Dam. It has been determined that the dam would be overtopped by the SDF by a maximum depth of 1.4 feet with an average critical velocity of 3.1 f.p.s. and would remain above the top of dam for 3.2 hours. The spillway will pass only 25 percent of the PMF and is therefore adjudged as inadequate.

The seepage at the downstream toe on both sides of the outlet pipe was too small to measure and, therefore, is not considered a threat to the stability of the embankment. However, the reservoir, at normal pool at the time of inspection, only created a head of approximately 15 feet and therefore the conditions did not represent the most serious seepage condition that may occur. For this reason, the seepage rate should be checked for increased flow at times when the reservoir is at higher levels.

The recommended remedial measures are not considered urgent and therefore may be accomplished as part of the annual maintenance and inspection program.

7.2 Recommended Remedial Measures: The following repair items should be completed as part of the general maintenance of the dam:

1) Remove brush and small trees from the area around the outlet works and scattered locations on the embankments.

2) Seed the wave erosion area on the upstream embankment with a water tolerant vegetation.

3) Remove the debris from the upstream embankment slope.

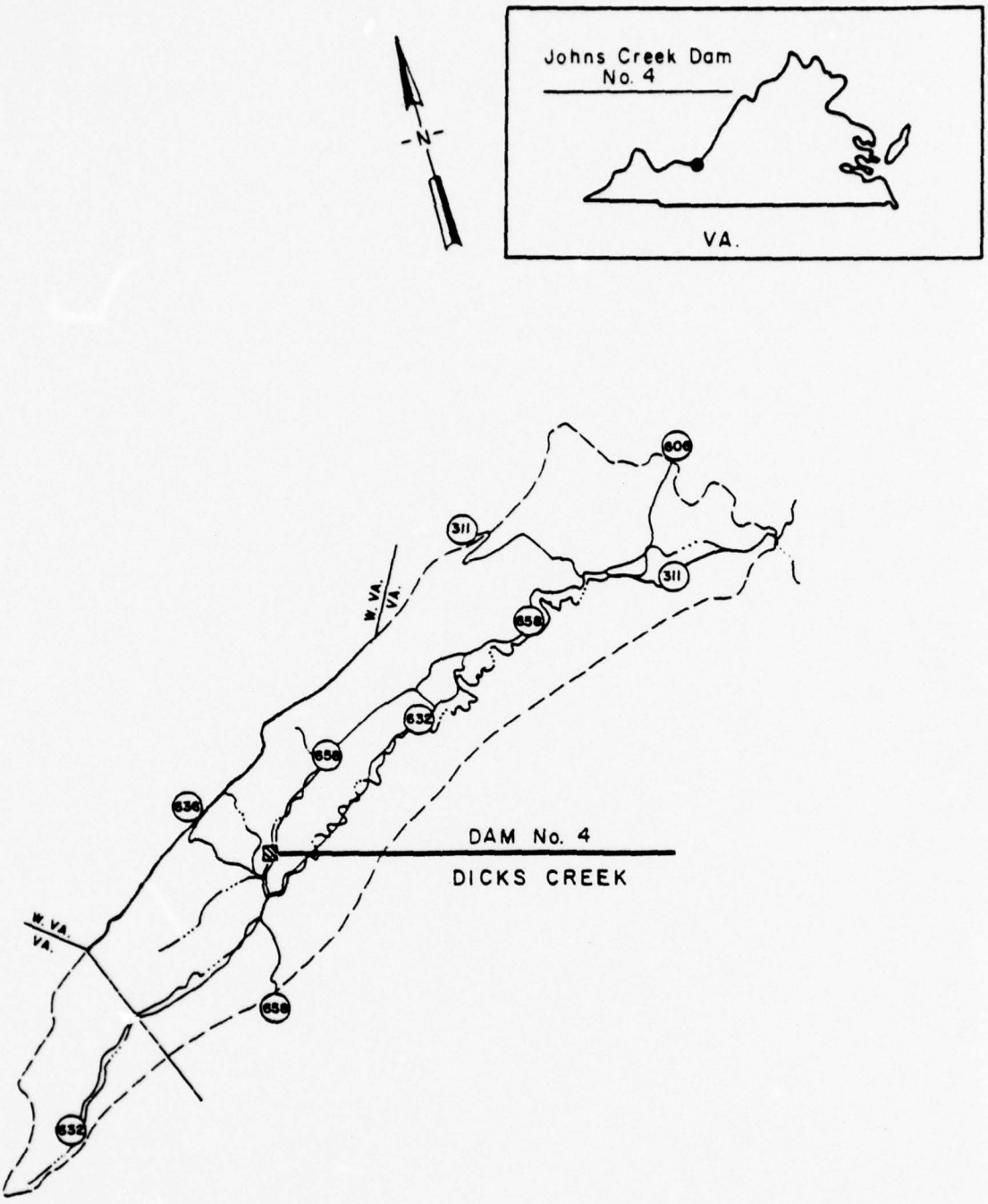
4) Install a staff gage to monitor reservoir levels above normal pool.

APPENDIX I

PLATES

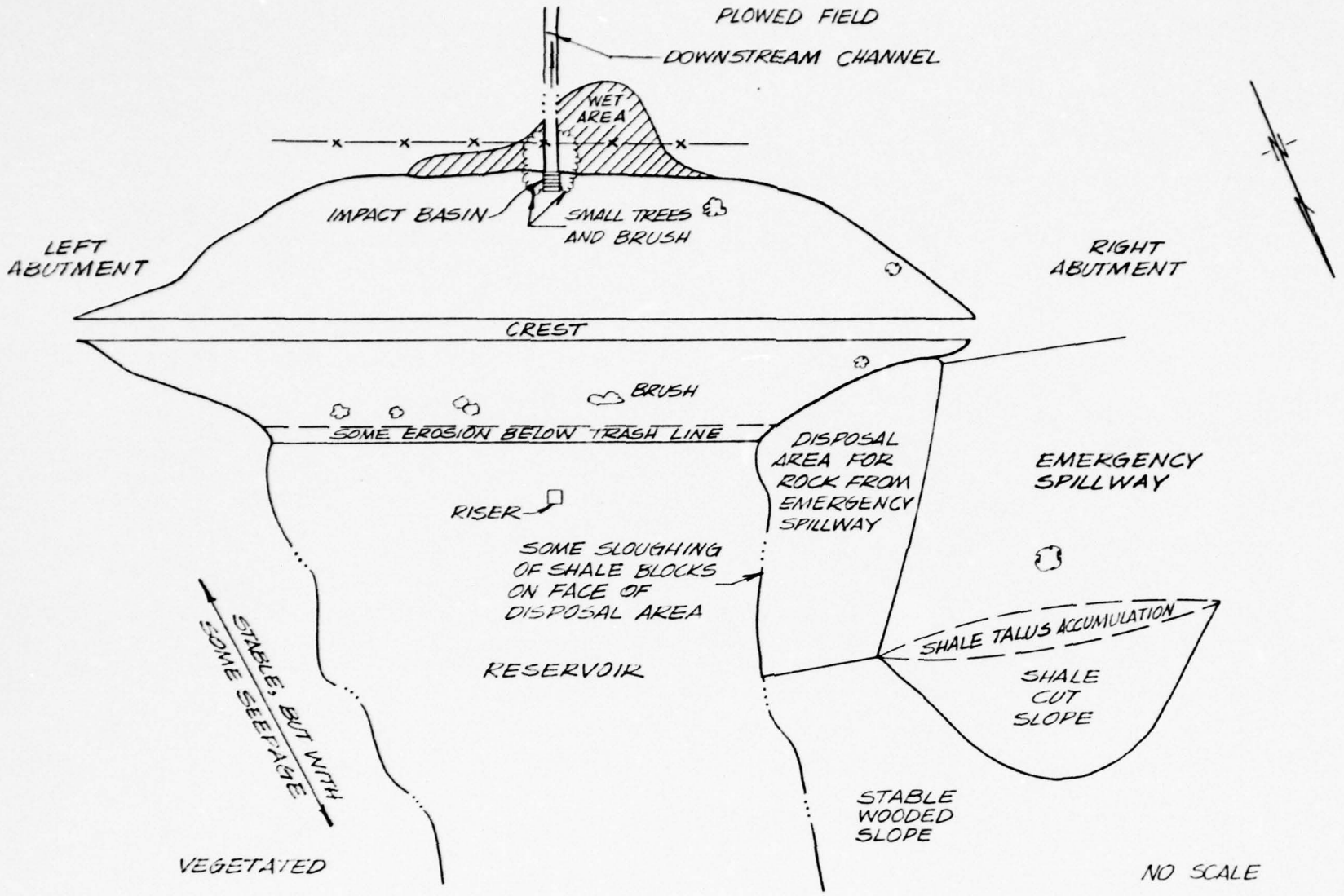
CONTENTS

NAME OF DAM: JOHNS CREEK No. 4



LOCATION PLAN

JOHNS CREEK DAM No. 4



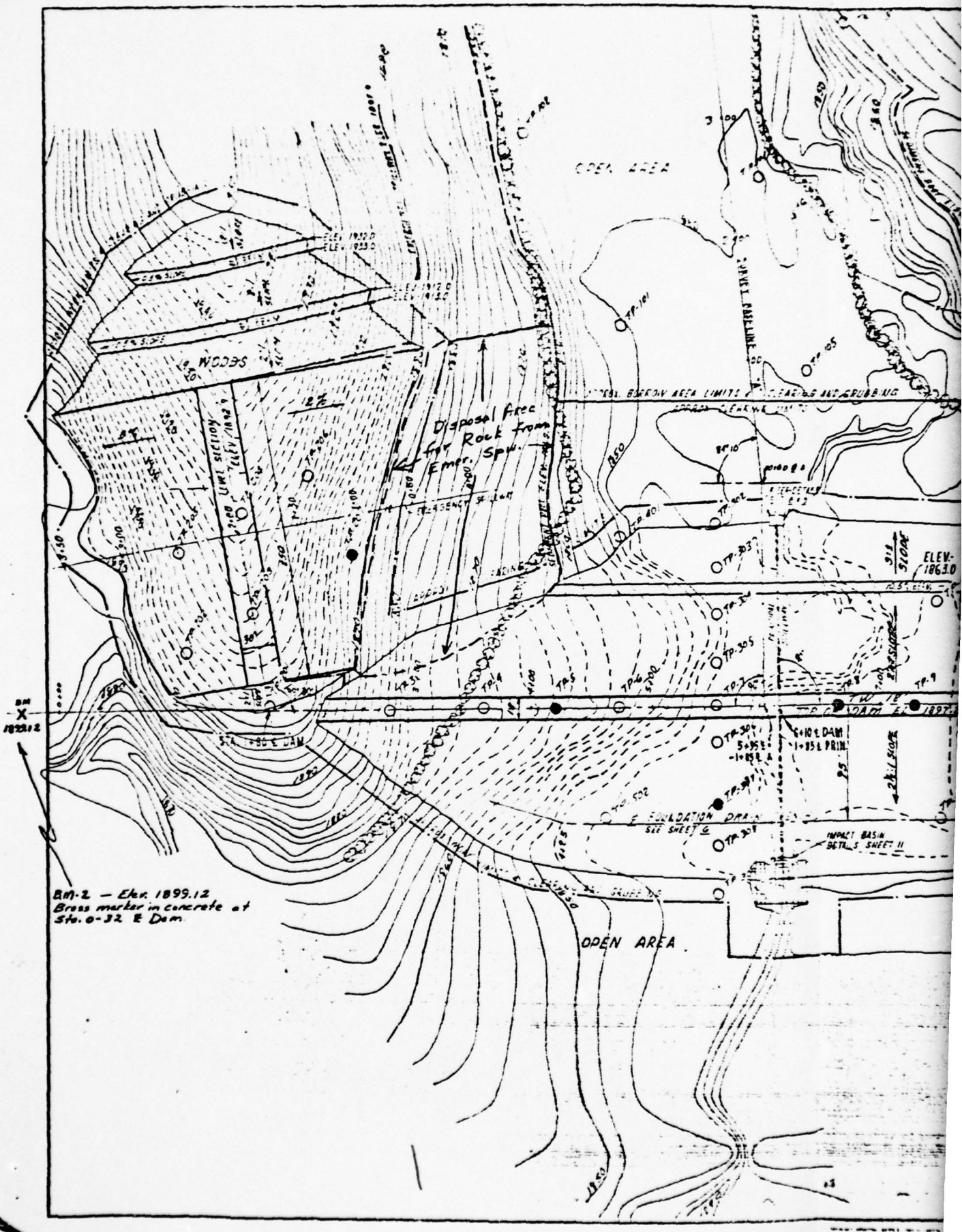
FIELD SKETCH

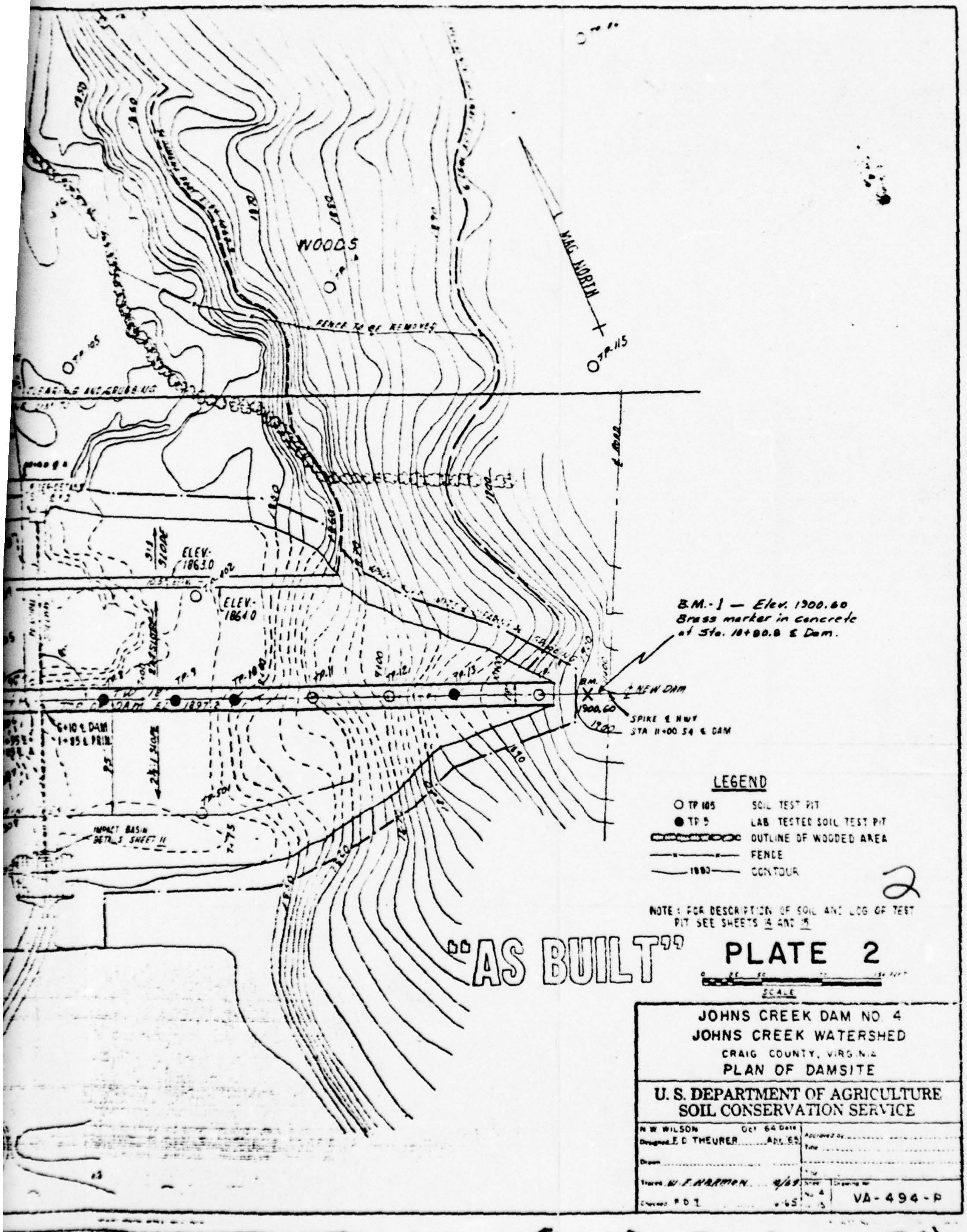
JOHNS CREEK DAM No. 4

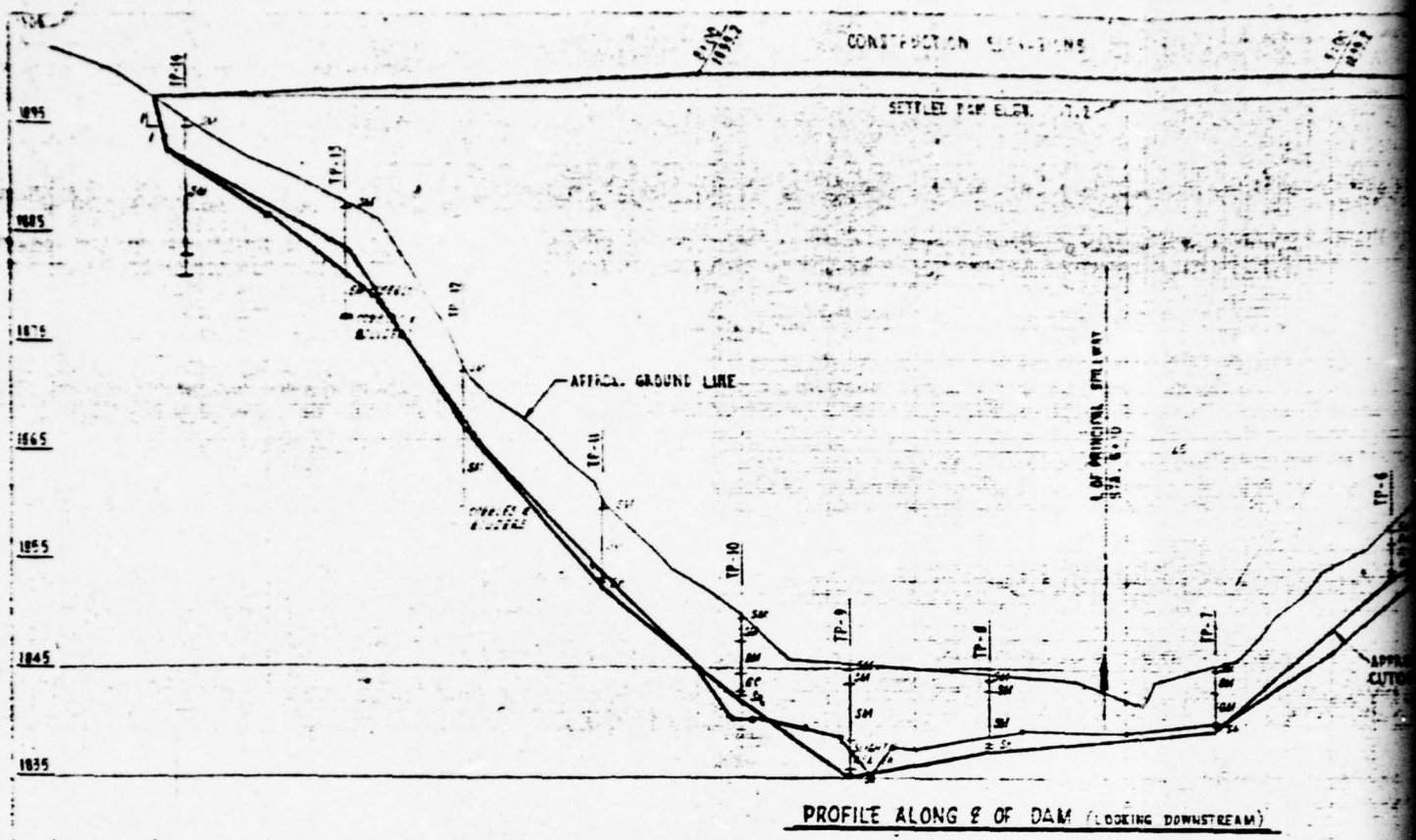
MICHAEL BAKER, JR., INC.

9 MAY 1979

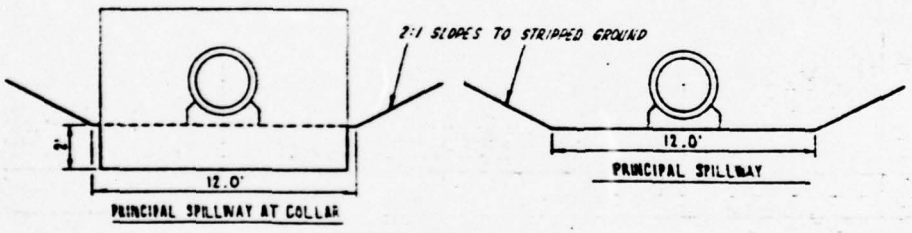
PLATE 1


OPEN AREA
WOODS
Disposal Area for Rock from Emer. Spwy.
GRAVEL BASELINE
ELEV. 1863.0
OPEN AREA
BM-2 — Elev. 1899.12
Brass marker in concrete at
Sta. 0+32 E Dam

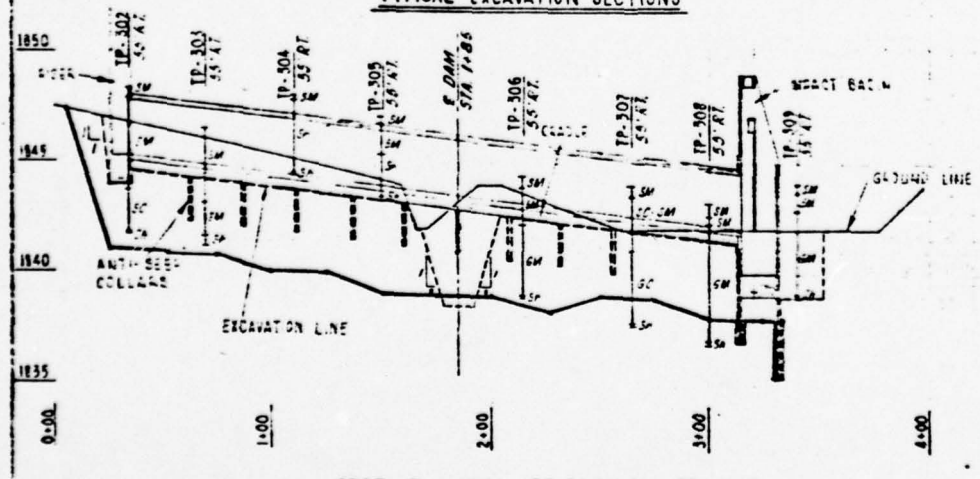

WOODS
MAG NORTH
FENCE TO BE REMOVED
TP-115
TP 105
ELEV. 1863.0
ELEV. 1864.0
B.M.-1 — Elev. 1900.60
Brass marker in concrete
at Sta. 10+80.8 ℄ Dam.
NEW DAM
SPIKE ℄ HWY
STA 11+00 54 ℄ DAM
IMPACT BASIN DETAILS SHEET 11
LEGEND
TP 105 SOIL TEST PIT
TP 5 LAB TESTED SOIL TEST PIT
OUTLINE OF WOODED AREA
FENCE
CONTOUR
NOTE: FOR DESCRIPTION OF SOIL AND LOG OF TEST PIT SEE SHEETS 14 AND 15
"AS BUILT" PLATE 2
SCALE
JOHNS CREEK DAM NO. 4
JOHNS CREEK WATERSHED
CRAIG COUNTY, VIRGINIA
PLAN OF DAMSITE
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
N W WILSON Oct 64
E D THEURER Apr 65
W. F. HARMON
VA-494-P
2



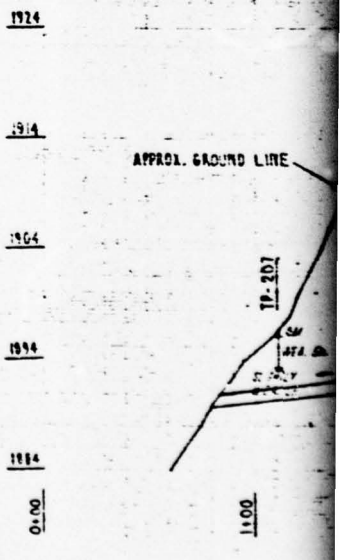
PROFILE ALONG ℄ OF DAM (LOOKING DOWNSTREAM)



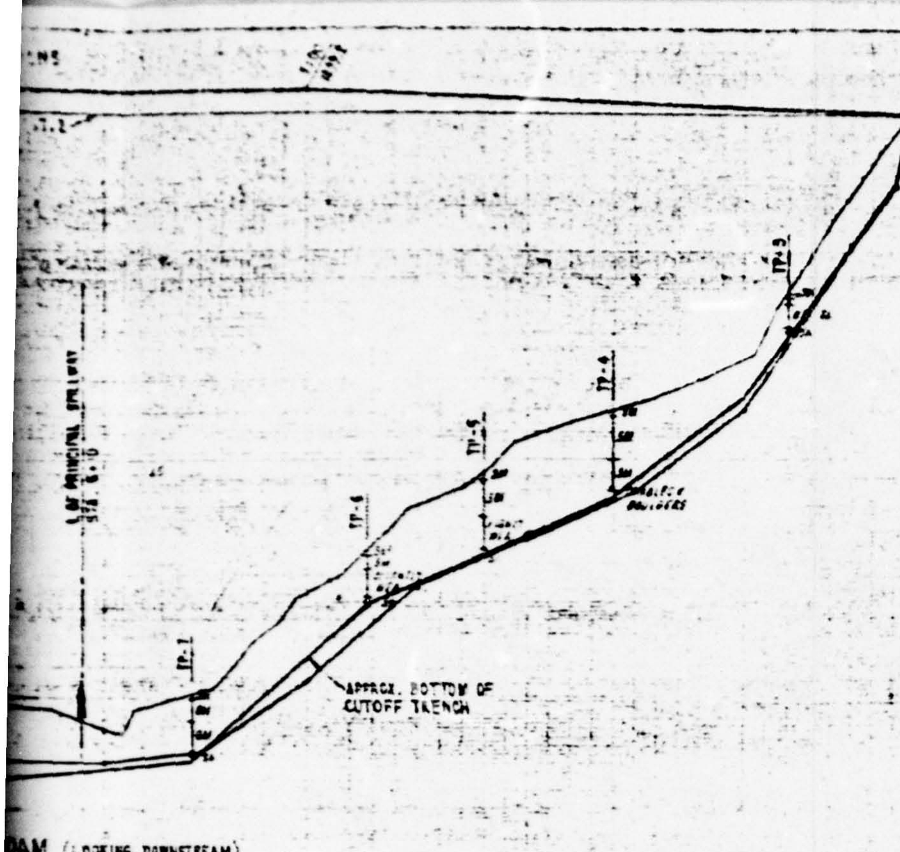
TYPICAL EXCAVATION SECTIONS



PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY



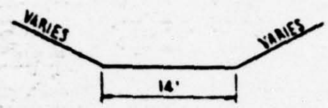
PROFILE



DAM (LOOKING DOWNSTREAM)

CUTOFF TRENCH SIDE SLOPES

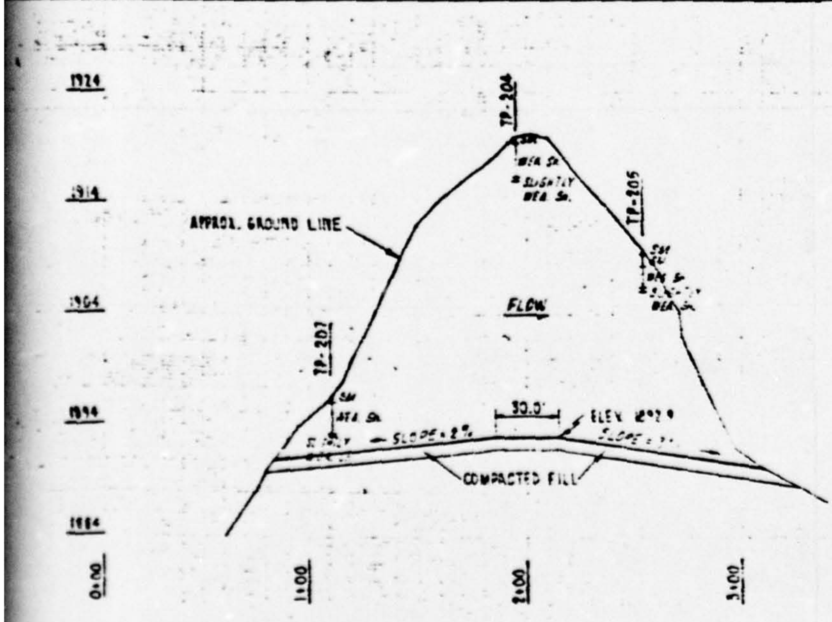
- ℄ STA. 2+22 TO 5+80 - 2:1
- ℄ STA. 5+80 TO 5+90 - TRANSITION SECTION
- ℄ STA. 5+90 TO 6+30 - 3:1
- ℄ STA. 6+30 TO 6+40 - TRANSITION SECTION
- ℄ STA. 6+40 TO 10+52 - 2:1



TYPICAL SECTION OF CUTOFF TRENCH EXCAVATION

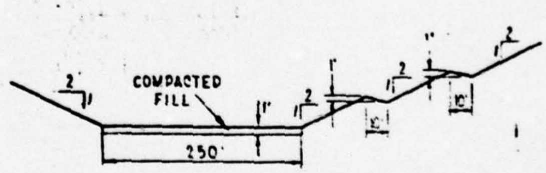
NOTE:
BACKFILL CUTOFF TRENCH WITH FINE GRAINED CLAYEY (CL) MATERIAL REPRESENTED BY THE LOGS OF TP-106 1' TO 7'
CLASS B-1 COMPACTED FILL

NOTE:
THE PROFILES OF THE BOTTOM OF ALL EXCAVATIONS AS SHOWN ARE APPROXIMATE. THE REQUIRED FINISHED GRADES WILL BE ESTABLISHED BY THE ENGINEER.
FOR DESCRIPTION OF LOGS SEE SHEETS 14 & 15



PROFILE ALONG ℄ OF EMERGENCY SPILLWAY

PLATE 3



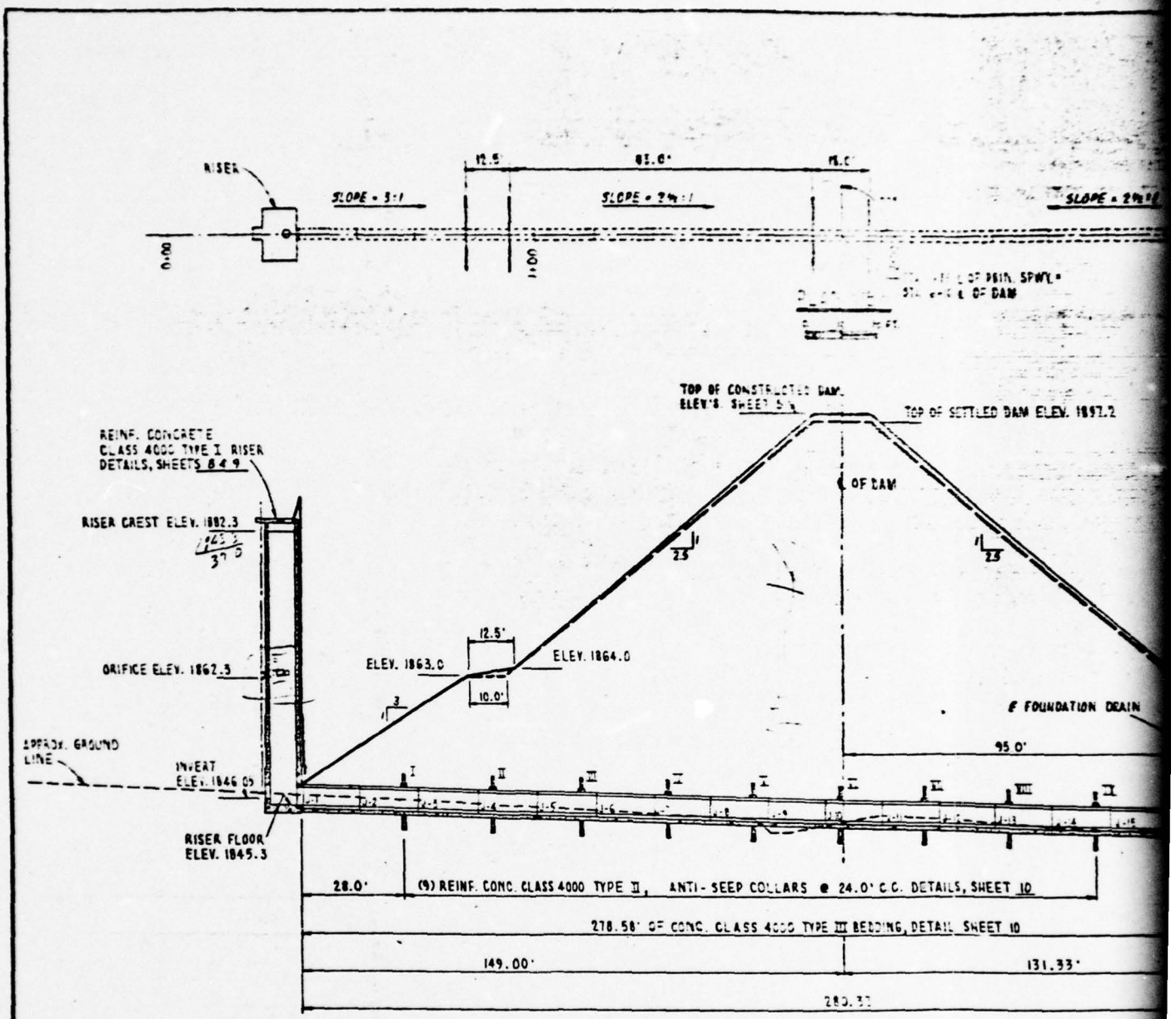
TYPICAL SECTION OF EMERGENCY SPILLWAY EXCAVATION

"AS BUILT"

JOHNS CREEK DAM NO. 4
JOHNS CREEK WATERSHED
CRAIG COUNTY, VIRGINIA
PROFILES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

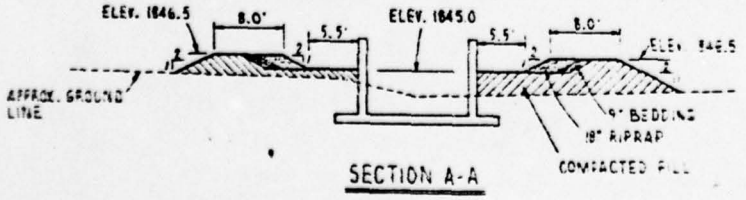
Designed F.D. THEURER	Apr. '65		
Drawn W. H. MORGAN	4-65		
F.D.T.	4-65	3 / 15	VA-494-P



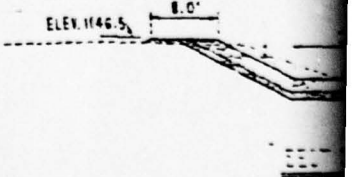
PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

HORI. SCALE 0 10 20 40 FT.

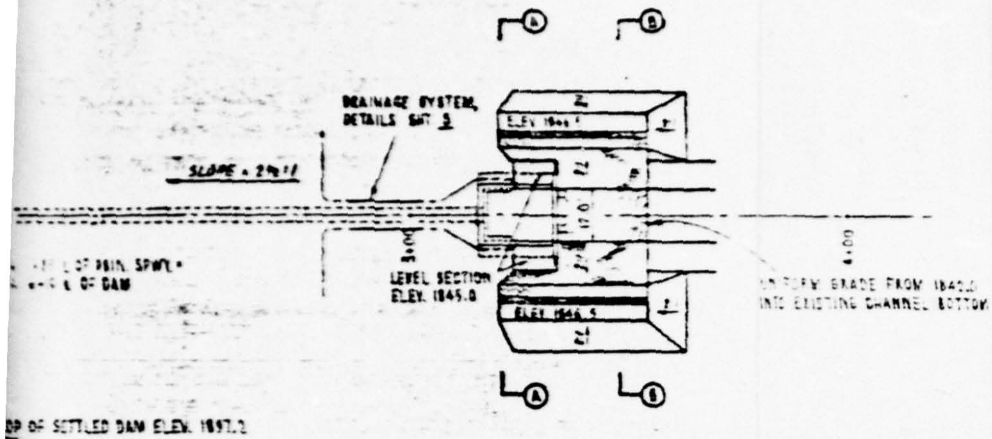
VERT. SCALE 0 5 10 20 FT.



SECTION A-A



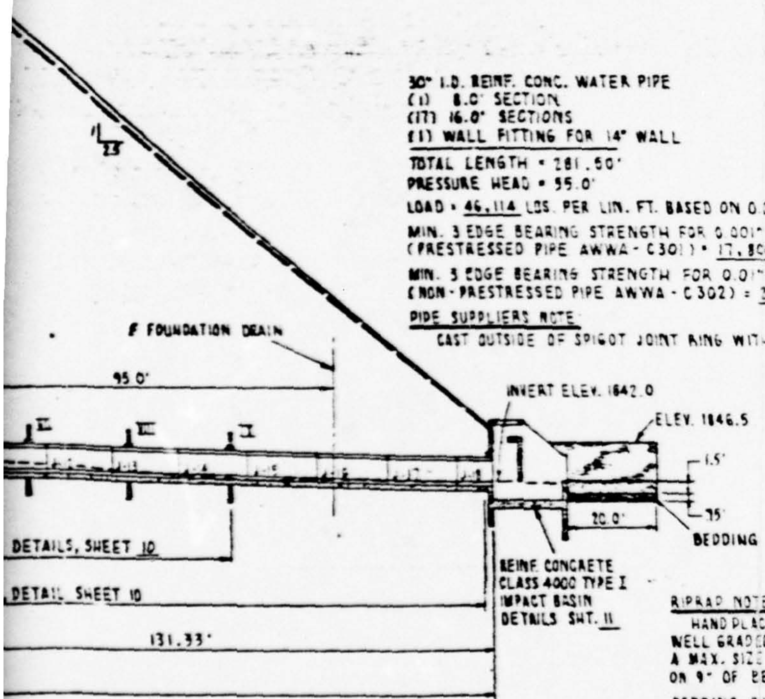
CHANNEL



JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF 30" DIA. PIPE	SLOPE
J-1	[illegible]	184[illegible]	S = 0.01186 [illegible]
J-2	16.33	184[illegible]	
J-3	32.33	1844 . [illegible]	
J-4	48.33	1844 . [illegible]	
J-5	64.33	1844 . [illegible]	
J-6	80.33	1844 . [illegible]	
J-7	96.33	1844 . [illegible]	
J-8	112.33	184[illegible] . [illegible]	
J-9	128.33	184[illegible] . 79 ±.01	
J-10	144.33	184[illegible] . [illegible]	
J-11	160.33	184[illegible] . 4[illegible]	
J-12	176.33	184[illegible] . [illegible]	
J-13	192.33	184[illegible] . [illegible]	
J-14	208.33	184[illegible] . [illegible]	
J-15	224.33	184[illegible] . 66 ±.01	
J-16	240.33	184[illegible] . 47 ±.01	
J-17	256.33	184[illegible] . 28 ±.01	
J-18	272.33	184[illegible] . 09 ±.01	
OUTLET	28[illegible].33	184[illegible] . 00	

NOTE:
ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV. OF 30" DIA. PIPE
I	28.0	1844 . 97
II	52.0	1844 . 69
III	76.0	1844 . 40
IV	100.0	1844 . 12
V	124.0	1843 . 84
VI	148.0	1843 . 56
VII	172.0	1843 . 27
VIII	196.0	1842 . 99
IX	220.0	1842 . 71



30" I.D. REINF. CONC. WATER PIPE
(1) 8.0' SECTION
(17) 16.0' SECTIONS
(1) WALL FITTING FOR 14" WALL
TOTAL LENGTH = 281.50'
PRESSURE HEAD = 55.0'
LOAD = 46,114 LBS. PER LIN. FT. BASED ON O.D. OF 3.17'
MIN. 3 EDGE BEARING STRENGTH FOR 0.001" CRACK (PRESTRESSED PIPE AWWA - C301) = 17,800 LBS. PER LIN. FT.
MIN. 3 EDGE BEARING STRENGTH FOR 0.01" CRACK (NON-PRESTRESSED PIPE AWWA - C302) = 23,600 LBS. PER LIN. FT.

PIPE SUPPLIERS NOTE:
CAST OUTSIDE OF SPIGOT JOINT RING WITH CONCRETE ON 8.0' SECTION

JOINT	JOINT GAP	
	TOP	BOTTOM
J-1	-1/8	-3/16
J-2	1/8	3/16
J-3	-1/8	-1/8
J-4	-1/8	-1/8
J-5	1/8	-3/16
J-6	-1/8	-1/8
J-7	-1/8	-1/8
J-8	+1/8	-1/8
J-9	-1/8	-1/8
J-10	-1/8	-1/8
J-11	-1/8	-1/8
J-12	-1/8	-1/8
J-13	-1/8	-1/8
J-14	1/8	1/8
J-15	-1/8	1/8
J-16	1/8	-1/8
J-17	1/8	1/8
J-18	-1/8	-1/8
OUTLET		

RIPRAP NOTE:
HAND PLACED LOOSE RIPRAP SHALL BE WELL GRADED FROM A MIN. SIZE OF 6" TO A MAX. SIZE OF 18" AND SHALL BE LAID ON 9" OF BEDDING.

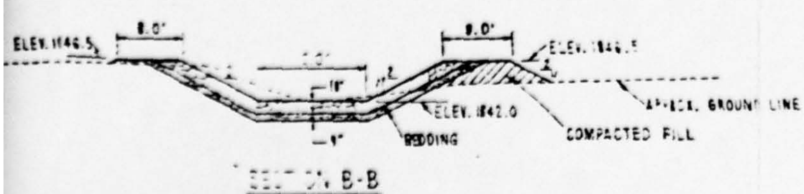
BEDDING SHALL MEET THE GRADATION REQUIREMENTS FOR "FILTER MATERIAL" AS SHOWN ON SHEET 6.

...CIPAL SPILLWAY
5 10 20 FT.
VERT. SCALE

PLATE 4

2

"AS BUILT"

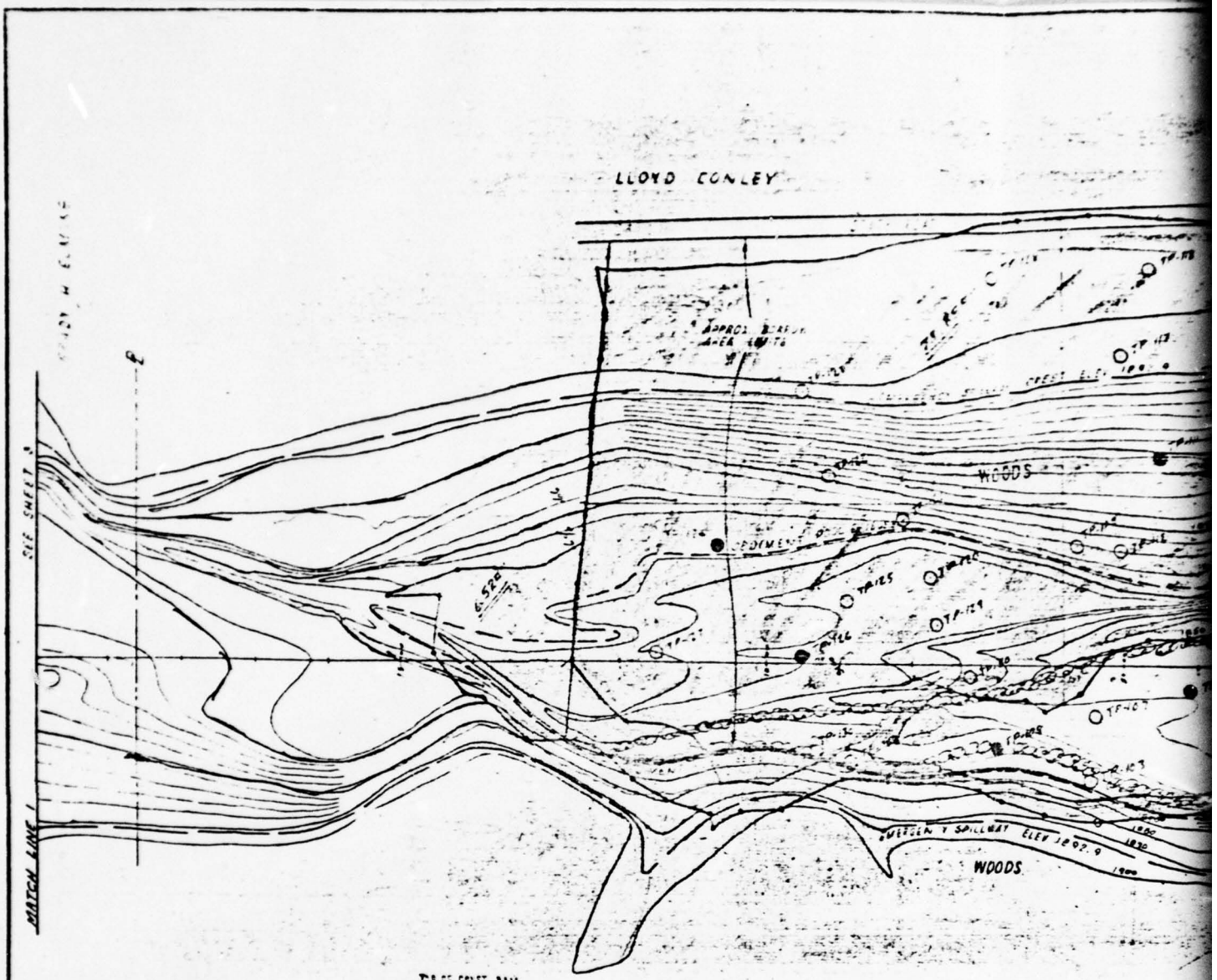


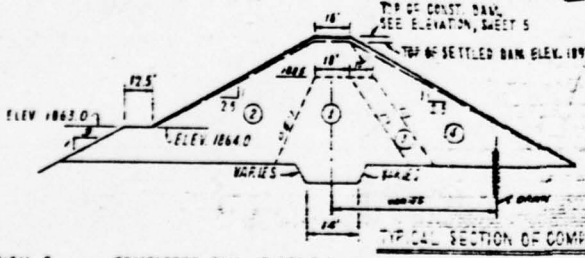
SECTION B-B
CHANNEL TRANSITION SECTION

JOHNS CREEK DAM NO. 4
JOHNS CREEK WATERSHED
CRAIG COUNTY, VIRGINIA
PLAN-PROFILE ALONG ℄ OF PRINCIPAL SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed: F.D. THEURER	Date: Apr. '65	Approved by	
Drawn: W.H. MORGAN	4-65	Title	
Traced		Title	
Checked: F.D.T.	4-65	Sheet No. 7 of 15	Drawing No. VA-494-P





SECTION 1 — COMPACTED FILL, CLASS E-1

FINE GRAVELLY AND CLAY (ML AND CL) REPRESENTED BY MATERIAL IN LOGS OF TEST PITS

SECTION 2 — COMPACTED FILL, CLASS E-1

SILTY AND CLAYEY SAND (SC-SM), REPRESENTED BY MATERIAL IN LOG OF TEST PIT

SECTION 3 — COMPACTED FILL, CLASS E-1

SILTY SAND (SM) REPRESENTED BY MATERIAL IN LOG OF TEST PIT

SECTION 4 — COMPACTED FILL, CLASS D

SHALE REPRESENTED BY MATERIAL IN LOG OF TEST PIT

NOTE

DESIGN OF THIS DAM WAS BASED UPON A MINIMUM WET DENSITY OF 122 LBS PER CU FT FOR COMPACTED SHALE MATERIAL.

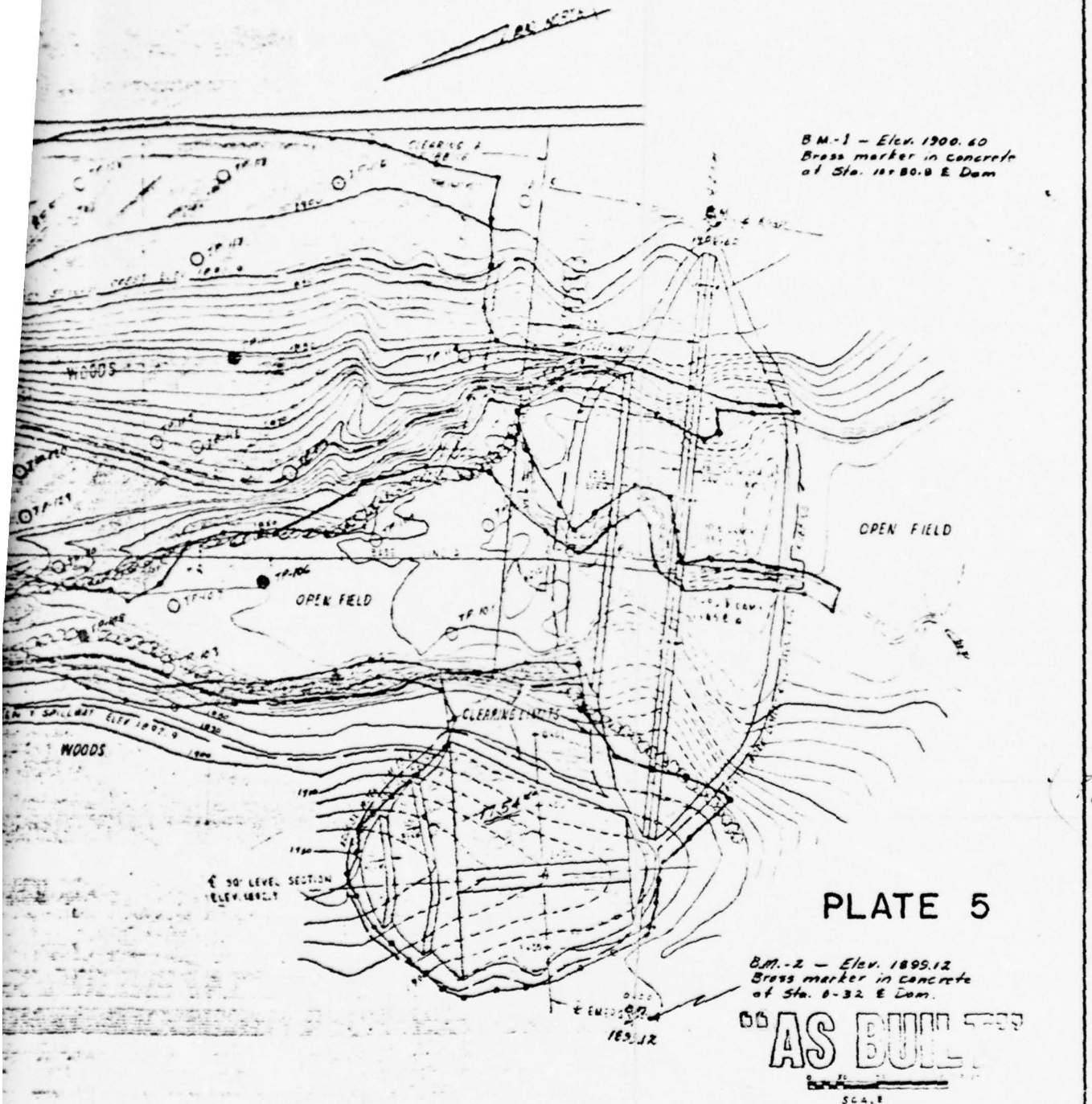


PLATE 5

LEGEND

- PROPERTY LINE
- TP HS SOIL TEST PIT
- OUTLINE OF WOODED AREA
- CLEARING
- CLEARING & GRUBBING

JOHNS CREEK DAM NO 4
JOHNS CREEK WATERSHED
CRAIG COUNTY, VIRGINIA
PLAN OF STORAGE AREAS & TYP. SECT OF COMPLETED FILL

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

N. W. WILSON Oct '64 DATE
Designed F. D. TREURER Apr '65
Drawn
Traced W. C. HARRISON
Approved by
Title
Scale
12-642-P

AS BUILT

APPENDIX II

PHOTOGRAPHS

CONTENTS

Note: Photographs were taken on 9 May 1979.

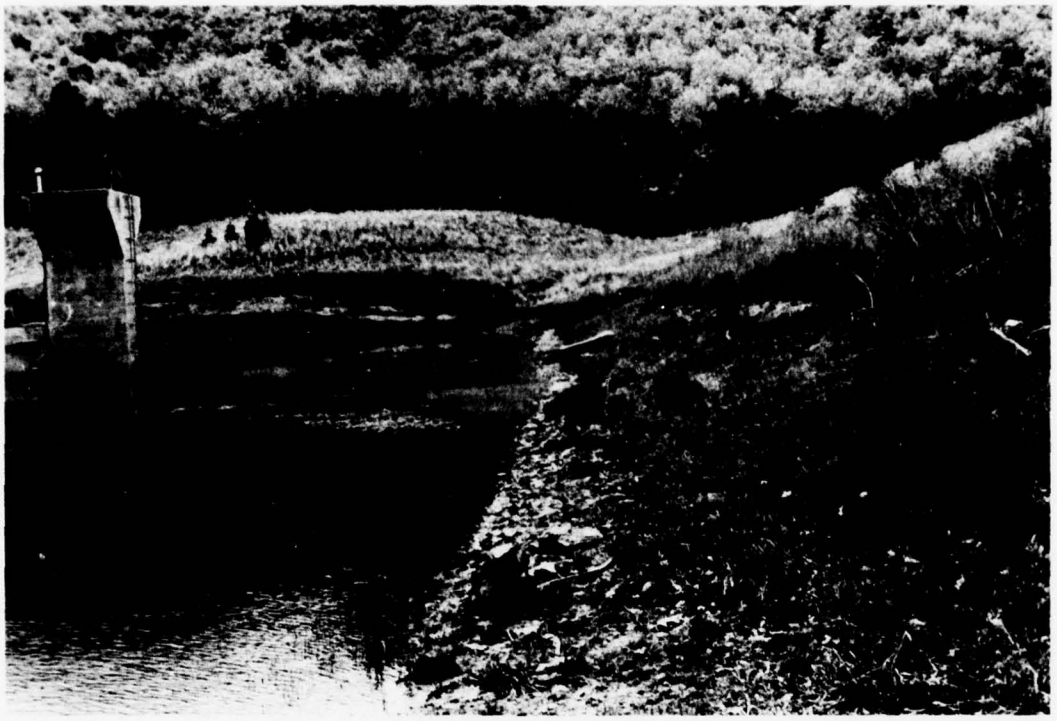


PHOTO 1. Upstream Embankment and Riser

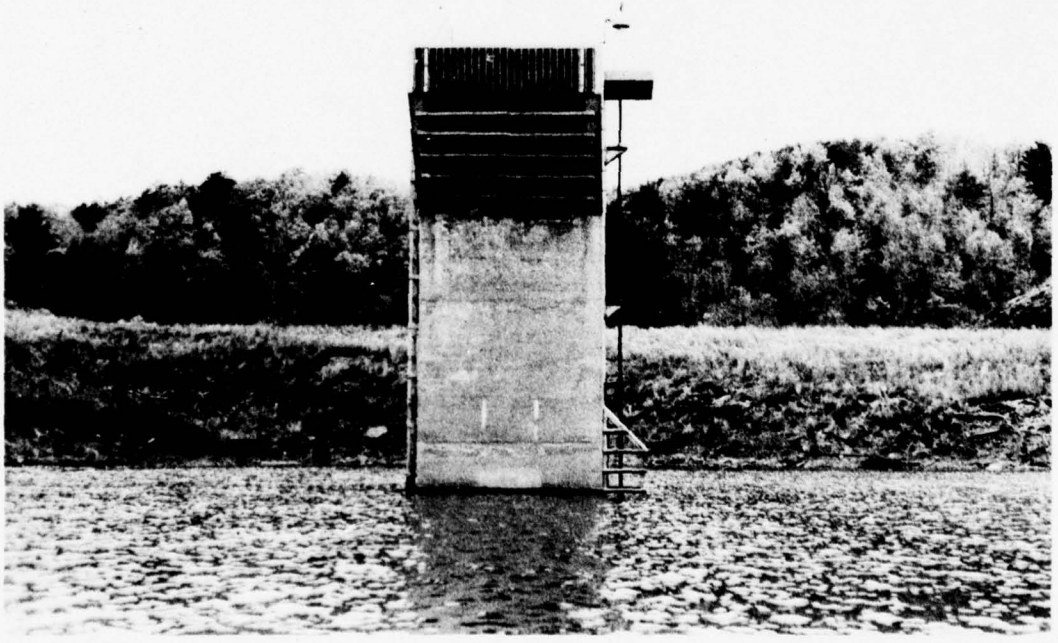


PHOTO 2. Riser with Trash Rack, Lift Pedestal and Stem for Reservoir Drain

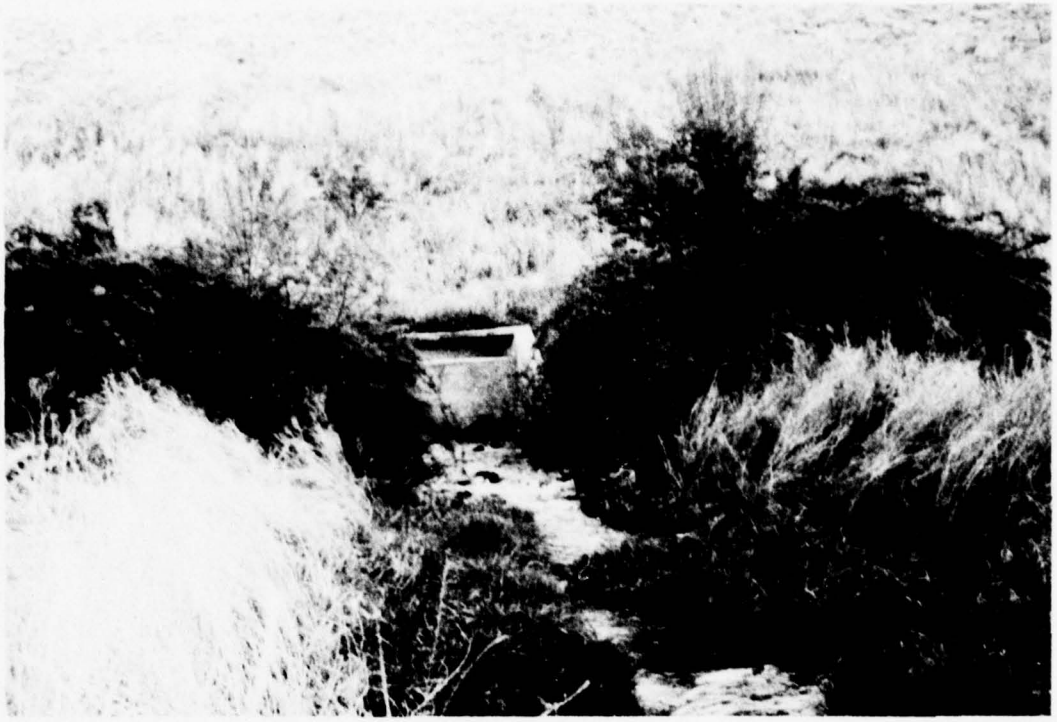


PHOTO 3. Impact Basin and Outlet Channel

PHOTO 4. Concrete Surface and Opening in Baffle Wall of Impact Basin

PHOTO 5. Upstream View of Emergency Spillway and Rock Disposal Area

PHOTO 6. Right Cut Slope of Emergency Spillway

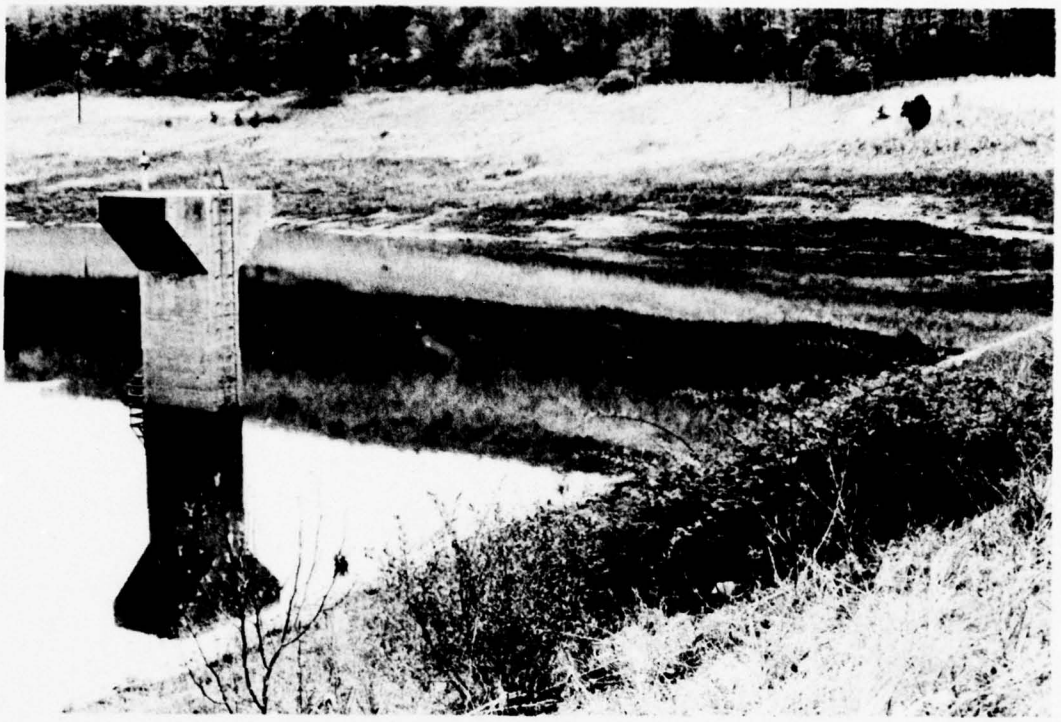


PHOTO 7. View of Left Reservoir Area from Upstream Embankment

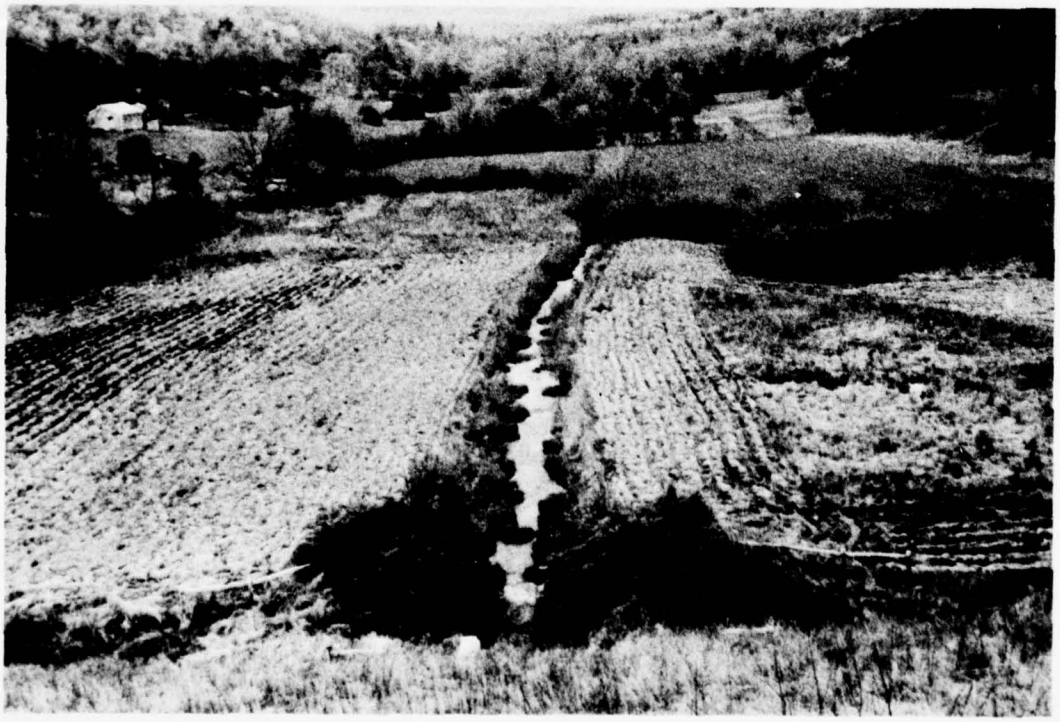


PHOTO 8. View of Downstream Channel Area

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name of Dam Johns Creek No. 4 County Craig State Virginia Coordinates Lat. 3726.3

Long. 8022.6

Date of Inspection 9 May 1979 Weather Partly Cloudy, Warm Temperature 75°F.±

III-1

Pool Elevation at Time of Inspection 1862.9 M.S.L. Tailwater at Time of Inspection 1842.5 M.S.L.

Inspection Personnel:

Michael Baker, Jr., Inc.:

T. W. Smith
D. Johns
B. M. Camlin

Virginia Water Control Board:

Hugh Gildea

B. M. Camlin Recorder

EMBANKMENT

Name of Dam: JOHNS CREEK No. 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor erosion was observed on the upstream face of the embankment below the elevation of the riser crest due to fluctuations in the reservoir levels during periods of high runoff.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignments of the crest coincide with the as-built drawings.	
RIPRAP FAILURES	The embankment does not contain any riprap.	

EMBANKMENT

Name of Dam: JOHNS CREEK No. 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Several small trees were observed on the upstream and downstream embankment faces. Sericea growth is well developed and provides adequate protection.	The trees should be removed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The junction of the rock disposal area with the embankment forms a non-uniform slope due to rock slabs at the juncture. The remaining upstream and downstream junctions were in good condition and well vegetated.	
ANY NOTICEABLE SEEPAGE	Minor seepage was noted at the toe of the embankment on the downstream side. Because water elevation in the reservoir was at normal pool, there was no significant head.	Seepage was too small to measure.
STAFF GAGE AND RECORDER	None observed	A staff gage should be installed to monitor reservoir levels above normal pool.
DRAINS	The 6 in. B.C.C.M.P. drain outlets were approximately 0.2 ft. submerged in the stilling basin; therefore no drainage could be observed.	

OUTLET WORKS

Name of Dam: JOHNS CREEK No. 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed	
INTAKE STRUCTURE	No cracking or spalling was observed; the exterior surfaces of the riser are in good condition.	
OUTLET STRUCTURE	The outlet structure consists of a baffle wall and an end sill dissipater. The outlet structure is in good condition. No cracking or spalling was observed.	Removal of briars, vines and small trees from the area of the outlet structure is recommended.
OUTLET CHANNEL	The outlet channel at the immediate end of the outlet works is partially obstructed by vine and tree growth.	
EMERGENCY GATE	The reservoir may be drained by use of the slide gate on the upstream side of the riser. Lift pedestal and stem guides appear to be in good working order.	

UNGATED SPILLWAY

Name of Dam: JOHNS CREEK No. 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTION	The control section is 250 ft. wide and 30 ft. long with a crest elevation of 1892.9 ft. M.S.L. and is heavily vegetated. The right cut slope of the emergency spillway is sloughed due to the weathering of exposed shale on the cut face.	
APPROACH CHANNEL	The approach channel is well vegetated with a 2% adverse slope. The rock disposal area contains some sloughing and minor erosion on the reservoir slope.	
DISCHARGE CHANNEL	The discharge channel is heavily vegetated; it has a slope of approximately 3% and discharges outside of the right abutment.	
BRIDGE AND PIERS	Not Applicable	

INSTRUMENTATION

Name of Dam: JOHNS CREEK No. 4

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	The bench marks noted on the as-built drawings were not located in the field.	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER		

RESERVOIR

Name of Dam: JOHNS CREEK No. 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Slopes upstream from the right abutment and emergency spillway are moderately steep, stable and covered with a heavy growth of mixed hardwoods and softwoods. Slopes upstream from the left abutment are relatively flat with good cover vegetation. Although there is some seepage, the slopes appear stable.	
SEDIMENTATION	Soundings around the riser indicate minor sedimentation.	

DOWNSTREAM CHANNEL

Name of Dam: JOHNS CREEK No. 4

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	With the exception of a few vines and small trees at the end of the impact basin, the downstream channel is in good condition with no obstructions or debris.	
SLOPES	The channel slope downstream of the dam is relatively flat (about 1%) and runs through a wide, flat field immediately downstream of the dam.	
APPROXIMATE NO. OF HOMES AND POPULATION	There are only 2 or 3 homes in the first mile downstream of the dam.	

APPENDIX IV

CHECK LIST - ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: JOHNS CREEK No. 4

ITEM	REMARKS
PLAN OF DAM	The Plan of Dam is shown on the as-built drawings and is included in this report as Plate 2.
REGIONAL VICINITY MAP	The vicinity map is presented in this report as the Location Plan.
CONSTRUCTION HISTORY	The contractor and completion date were obtained from the COE. The dam was constructed by Curtis Horton in 1967.
TYPICAL SECTIONS OF DAM	The typical sections are included in the as-built drawings and are presented in this report as Plates 3, 4 and 5.
HYDROLOGIC/HYDRAULIC DATA	Hydrologic and hydraulic calculations were available.
OUTLETS - PLAN and DETAILS	Shown in the as-built drawings.
- CONSTRAINTS and DISCHARGE RATINGS	Contained in the hydrologic/hydraulic calculations.
RAINFALL/RESERVOIR RECORDS	No rainfall or reservoir records are available at the dam.

Name of Dam: JOHNS CREEK No. 4

ITEM	REMARKS
DESIGN REPORTS	Design Reports were obtained from the SCS.
GEOLOGY REPORTS	Data on detailed geologic investigations are contained in the Design Report and included in Appendix VII (pages 2, 4, 6 and 7 of the report were not available for review).
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS	Hydrology and hydraulic calculations were available for this inspection report.
DAM STABILITY SEEPAGE STUDIES	Stability analyses were available for this inspection report and are included in Appendix VI. This information is incomplete because the beginning pages of the memorandum accompanying the analyses were not available for review. In addition, summary sheets and sketch numbers 2, 3 and 4 were not provided.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Test pit and boring records, resistivity data compaction curves and results of laboratory analyses were printed in the as-built drawings and/or in the Detailed Geologic Report.
POST-CONSTRUCTION SURVEYS OF DAM	No known post-construction surveys were found.
BORROW SOURCES	Borrow sources in the reservoir area are shown on the as-built drawings.

Name of Dam: JOHNS CREEK No. 4

ITEM	REMARKS
MONITORING SYSTEMS	No monitoring systems have been provided.
MODIFICATIONS	Data obtained during the inspection agrees closely with the as-built drawings, indicating that no major modifications were made.
HIGH POOL RECORDS	None available
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No prior accidents or failure of the dam have been noted.
MAINTENANCE OPERATION RECORDS	Annual inspections are conducted by the Natural Bridge Soil and Water Conservation District. Copies of the reports are included in Appendix V.

Name of Dam: JOHNS CREEK No. 4

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS and DETAILS	Information contained in the as-built drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Information contained in the as-built drawings.

APPENDIX V

OPERATION AND MAINTENANCE INSPECTION REPORTS

COMMONWEALTH OF VIRGINIA

NATURAL BRIDGE SOIL AND WATER CONSERVATION DISTRICT

May 25, 1979

Route 1, Box 274
Daleville, VA 24083

Thomas W. Smith
Michael Baker, Jr. Inc.
Engineers and Surveyors
4301 Dutch Ridge Road
Box 280
Beaver, Pennsylvania 15009

Dear Mr. Smith:

Enclosed are copies of the last five(5) years operation and maintenance inspection reports of the dams on Johns Creek Watershed. These are the reports you requested by letter dated May 17, 1979.

We would like to receive a copy of your inspection report for our information and files.

Sincerely,

Jack W. Bostic (eas)

Jack W. Bostic, Chairman

Enclosures

W/S

P. O. Box 56
Pincastle, Va. 24090

June 9, 1978

David H. Grimsood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Va. 23240

Subject: NBSWCD Annual O&M Report (1978) Johns Creek Watershed

Dear Mr. Grimsood,

District Director J. Francis Rose and myself along with D. A. Towler, District Conservationist made the annual operation and maintenance inspection of the Johns Creek Watershed project on June 6, 1978.

All structures (Nos. 1,2,3 and 4) were found to be in a safe and satisfactory operating condition. The water levels were at their normal levels. The concrete risers and principal spillways along with the metal trash racks and ladders were found to be in good condition.

The vegetative cover on all dams was in good condition, Dam No. 3 was being grazed and at present the grazing was at an acceptable level.

Considerable debris has accumulated along the face of Dam #2 and needs to be removed.

The repair work has been completed by the district to the gully in the access road leading to the Emergency Spillway on Dam #2 (this item mentioned in the 1977 O&M report).

Conservation plans have been developed during the present calendar year to cover Dams #2 and 3. These conservation plans with the land user will be used as the basis for normal maintenance of these areas.

P. B. Hughston
Chairman, Natural Bridge SWCD

D. A. Towler
District Conservationist

cc: J. M. Betts w/enclosures

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Rt. 1 Box 274
Daleville, Va. 24083

SUBJECT: W/S - Johns Creek Watershed
Annual Operation and Maintenance Inspection

DATE June 2, 1977

TO: J. M. Betts
Area Conservationist
Harrisonburg, Va.

This is a report of subject inspection of Dams 1, 2, 3 and 4 made jointly by the Natural Bridge SWCD Director Francis Ross and SCS District Conservationist D. A. Towler on May 24, 1977.

In general all four dams were found to be in very good condition. A small amount of debris was found deposited along the high water lines from a heavy rain in early spring. This debris is lightly scattered and no problems are anticipated.

The low stage orifice on Dam #2 has a small amount of debris in the opening. The present lessor of the lake will be contacted by the NBSWCD to remove this obstruction. The access road to the EDE on Dam #2 is eroding beside the stone that the NBSWCD used in 1976 to fill a similar small gully. The NBSWCD will contact a contractor to discuss arrangements on repairing this gully.

Francis Ross
Natural Bridge SWCD Director

D. A. Towler
SCS District Conservationist

Water Resource Committee Mr. Tawler D.

COMMONWEALTH OF VIRGINIA

NATURAL BRIDGE SOIL AND WATER CONSERVATION DISTRICT
P. O. BOX 56, FINCASTLE, VIRGINIA 24090

June 23, 1976

David N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Virginia 23240

SUBJECT: NBSWCD Annual O & M Inspection Report 1976, Johns Creek Watershed Project

Dear Mr. Grimwood:

District Director J. F. Ross and myself, accompanied by Huey Kelly and W. B. Garrett (local SCS technicians) made the NBSWCD annual inspection of the completed portion (floodwater retarding structures Nos. 1, 2, 3, and 4) of the Johns Creek Watershed Project June 11.

All structures appeared to be safe and operating satisfactorily.

Specific Findings:

Dam #1 - Overall appearance - good; vegetative cover - 98% sericea (ungrazed and unmowed); fertilizing needed in part of emergency spillway to rejuvinate thin area; berm and portion of dam adjacent to normal pool level mostly bare, needs to be established in a water tolerant cover such as Reed' Canary grass -; riser openings clear; small amount of debris on face of dam, small trees adjacent to loose rock gutters at end of dam need removing.

Dam #2 - Overall appearance - good. Vegetative cover same as #1, (the Natural Bridge District had repaired the gully mentioned in it's 1975 O & M report); there was some debris around 1st stage riser intake and considerably more on face of dam and south bank of the permanent pool. Bare car tracks evidenced too much travel through the emergency spillway; (the district has initiated steps to control this).

Dam #3 - Overall appearance - good; vegetative cover same as #1.

Dam #4 - Overall appearance - good; vegetative cover same as for #1. Change in 1st stage opening made by SCS last fall appears to have corrected the too slow draw down problem.

No major flooding conditions took place in the watershed during the past year.

The NBSWCD expresses appreciation to the USDA - SCS for work performed as needed to correct the 1st stage opening of riser at the No. 4 dam.

Sincerely,

P. D. Hughston

P. D. Hughston
Chairman, NBSWCD District

December 16, 1975

David N. Grimwood
State Conservationist
Soil Conservation Service
P. O. Box 10026
Richmond, Va. 23240

SUBJECT: NBSWCD Annual O&M Report (1975) Johns Creek Watershed

Dear Mr. Grimwood:

District Director J. F. Ross and myself made the NBSWCD annual inspection of the completed portion (floodwater retarding structures Nos. 1,2,3 and 4) of the Johns Creek Watershed Project on August 19, 1975.

All structures were found to be in substantially safe and satisfactory operating condition with the following exceptions:

Structure No. 4 - Due to the relatively small size of the first stage opening in the riser, moderately wet periods result in waters standing over much of the "designed" temporary storage area too long and no vegetative cover could be maintained on these lands. This condition also lowered the flash flood storage potential considerably. (District Conservationist Dwight Towler, USDA, SCS informed our directors in November that the SCS had completed work on the riser designed to correct this situation.)

Structure No. 2 - An active gully 1 to 2 feet in depth 200+ feet long was cutting into the steep access area leading from the emergency spillway. While not presently affecting the structures operation, if left unstabilized, this gully could develop into a serious source of erosion and sediment.

The District is currently considering alternatives for correcting this problem but no final decision has been made to date.

The protection given by these dams during the past years intensive rains on Johns Creek was appreciatively noted by many people living in that valley.

Yours very truly,

P. D. Hughston

P. D. Hughston
Chairman Board of Directors

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE - P. O. Box 47, Pincastle, Va. 24090

SUBJECT WS - Johns Creek Watershed
Annual Maintenance Inspection

DATE Jan. 10, 1975

TO Wm. D. Richardson
Area Conservationist
Soil Conservation Service
Route 1, Box 274
Daleville, Virginia 24083

This is a report of the annual maintenance inspection on Johns Creek Watershed Dams 1, 2, 3, and 4. This inspection was made jointly by Natural Bridge SWCD Director Jack Larkins, SCS District Conservationist D. A. Towler, and SCS Technician W. B. Garrett on January 9, 1975.

In general all four dams were found to be in very good condition. Some erosion is occuring on the area below the EMS on Site #2 which was damaged and subsequently repaired following the May 28, 1973 storm.

No progress has been made in obtaining a contractor to make the planned alterations to the low stage orifice on Dam #4.

Jack Larkins
Natural Bridge SWCD Director

D. A. Towler
SCS District Conservationist

APPENDIX VI

STABILITY ANALYSES

3 -- R. C. Burnet -- 12/31/54
Roy S. Decker
Subj: ENG - Soil Tests 22 - Virginia WP-08, Johns Creek, Site No. 4 (Craig County)

C. Permeability: A test was made on Sample 65W803 (111.1) compacted to 95% of maximum standard density. A rate of k = 0.0009 ft./day was recorded. It appears that with exception of the SM the permeability of all the soil materials submitted will be very low.

D. Shear Strength: Tests were made on the SC-SM sample, 65W803 (111.1), at both 94% and 98% of maximum standard density. Resulting shear parameters were ϕ = 25.5°, c = 150 p.s.f. and ϕ = 28°, c = 550 p.s.f., respectively, on a total stress basis.

E. Consolidation: Based on the consolidation phase of the shear test, it appears that a potential of about 0.06 ft./ft. is to be expected in the SC material at the base of the fill.

SLOPE STABILITY ANALYSIS:

Slope stability was checked by a circular failure method. The slopes would have to be considerably revised for the strength shown by the placement at the lower density.

For placement at 98% of maximum standard density and embankment shear strength of ϕ = 28°, c = 550 p.s.f., the floodplain section is most critical. Minimum safety factors are as follows:

Upstream: On the 2 1/2:1 over 3:1 slope with 13' berm and slope change at elevation 1863.0 - F_s = 1.35.

Downstream: For 2 1/2:1 slope with drain at c/b = 0.6 - F_s = 1.57.

SETTLEMENT AND STRAIN ANALYSIS:

Based on the classification of foundation and embankment materials and the topographic features, no unusual problems are anticipated due to settlement and the resultant strains.

CONCLUSIONS AND RECOMMENDATIONS

A. Cutoff: A cutoff to firm bedrock is recommended across the floodplain and lower abutments from Station 4+50 to 8+50. Above this (elevation 1860.0), a depth of cutoff is recommended sufficient to intercept any surface disturbances such as root holes, burrows or ground cracks. This will require a 4' to 5' depth in the abutments and up to 10' across the floodplain. (See line for proposed trench bottom on centerline profile.)

A normal trench bottom width of 12' to 15' is sufficient.

-- R. C. Barnes -- 12/31/64
Rey S. Decker
Subj: ENG - Soil Tests 22 - Virginia WP-08, Johns Creek, Site No. 4 (Craig County)

Backfill with fine CL material like 65W801 (106.1) against the rock surfaces. As backfill progresses, CL's like 65W804 and 65W805 (124.1 and 126.1) can be used.

Place all backfill at 98% of maximum standard density with moisture controlled wet of optimum.

B. Principal Spillway: Bedrock profile at the proposed location is not uniform. A location 25' to 50' to the left may provide a more uniform rock surface under the conduit.

In either location it appears desirable to construct a stilling basin down into the shale to prevent a wide scour hole.

Unless nonuniform rock surface soils or density conditions are anticipated, the SC-SM and GC soils from TP # 307 should provide a good base for the pipe cradle and no undercutting is recommended except to remove cobbles and boulders to form a fine grade.

Camber is not recommended and horizontal strain should not exceed 0.004 ft./ft.

Backfill with fine CL against the pipe and use other CL for backfill as noted in the section on core trench backfill.

Use $\phi = 30°$ to represent the strength of moist backfill in conduit loading computations.

C. Drainage: A drain is recommended to control the phreatic line and prevent piping in the deep boulder areas of both abutments.

A trench drain at c/b = 0.6 with a perforated pipe outlet across the floodplain section and blind trenches up the abutments is suggested. It should extend laterally from ℄ Station 3+00 to Station 9+10.

The trench should bottom in the cobbles or fractured shale throughout. This will result in trench depths of about 3' to 14'.

Suggested filter limits are shown on the attached Form SCS-353.

D. Embankment Design: The following are recommended:

1. Use the finer and more plastic CL's and ML in the backfill and center section. Use the SM or GM in the downstream base. Place the shale in the downstream section above the phreatic line if possible.

-- R. C. Barnes -- 12/31/64
Rey S. Decker
Subj: ENG - Soil Tests 22 - Virginia WP-05, Johns Creek, Site No. 4 (Craig County)

2. Place all soil material at 98% of maximum standard density with compaction control based on the minus # 4 screen size. Place the shale at a minimum mass dry density of 122.0 p.c.f. with moisture added to total 7% to 8%.

   Minimum dry densities and recommended placement moisture ranges are shown on Form SCS-372.

3. Make the upstream slope 2 1/2:1 over 3:1 with slope break and a 13' berm at elevation 1863.0. Make the downstream slope 2 1/2:1 with a drain at c/b = 0.6.

4. Provide 2.0' overfill from Station 5+50 to 8+00 to compensate for residual settlement of about 1.5' in the fill and about 0.5' in the foundation.

Prepared by:

Roland B. Phillips

Attachments

cc: R. C. Barnes (5)
K. M. Kautz, Upper Darby, Pennsylvania (2)

FORM SCS-347
12-66

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Norman Section

SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State Virginia Project John's Creek Stage 4

Date 12-9-64 Analysis Made By T.C.H Checked By EWL

Method of Analysis Swedish Circle

Location of Material	Fill SC				Emb 25% Std SC-SM		Emb 95% Std SC-SM		Emb 25% Std Shale	
Sample No.	65W793				65W802		65W803		65W570	
γ_d	96.6				105.7		110.2		120.0	
γ_m					122.5		126.5		129.5	
γ_s	120.5				122.0		130.5		134.0	
γ_b	58.0				61.5		68.0		73.5	
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ		25.5°				25.5°		28.0°		32.0°
Tan ϕ		0.477				0.477		0.532		0.610
K										
C		325				150		550		450

UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
1	~~2½:1~~ 3:1	Full draw down - 10' berm Elev 1863.0 - Arc cut from upstr slope thru emb 95%-Std (25.5°-150) only - Sat shear values only	2.92
1A	~~2½:1~~ 3:1	Same as #1 except 98% Std. emb. (28.0°-550)	1.61

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs

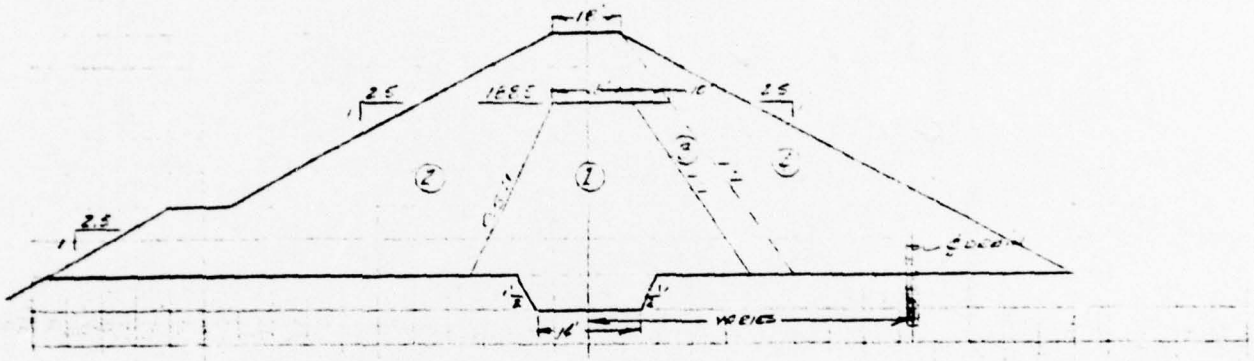
USDA-SCS-LINCOLN, NEBR. 1966

SCM-61

COMPUTATION SHEET
SCS-523 REV 5-56

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE		PROJECT		
BY	DATE	CHECKED BY	DATE	JOB NO.
SUBJECT "TYPICAL EMBANKMENT SECTION"				SHEET ____ OF ____



Sec 1 E-1 COMPACTED FILL

FINE GRAIN SILT AND CLAY (ML AND CL), REPRESENTED BY MATERIAL IN LOGS OF TEST PITS:

102, 1-2.4'
106, 1-7'
124, 1.7-7.2'
126, 1-4.9'

Sec 2 E-1 COMPACTED FILL

SILTY AND CLAYEY SAND (SC-SM), REPRESENTED BY MATERIAL IN LOG OF TEST PIT 111, 1-17.2'

Sec 3 E-1 COMPACTED FILL

SILTY SAND (SM), REPRESENTED BY MATERIAL IN LOG OF TEST PIT 108, 1-6.7'

Sec 4 122 POUNDS PER CUBIC FOOT MASS DENSITY

SHALE, REPRESENTED BY MATERIAL IN LOG OF TEST PIT 207, 1-3.5'

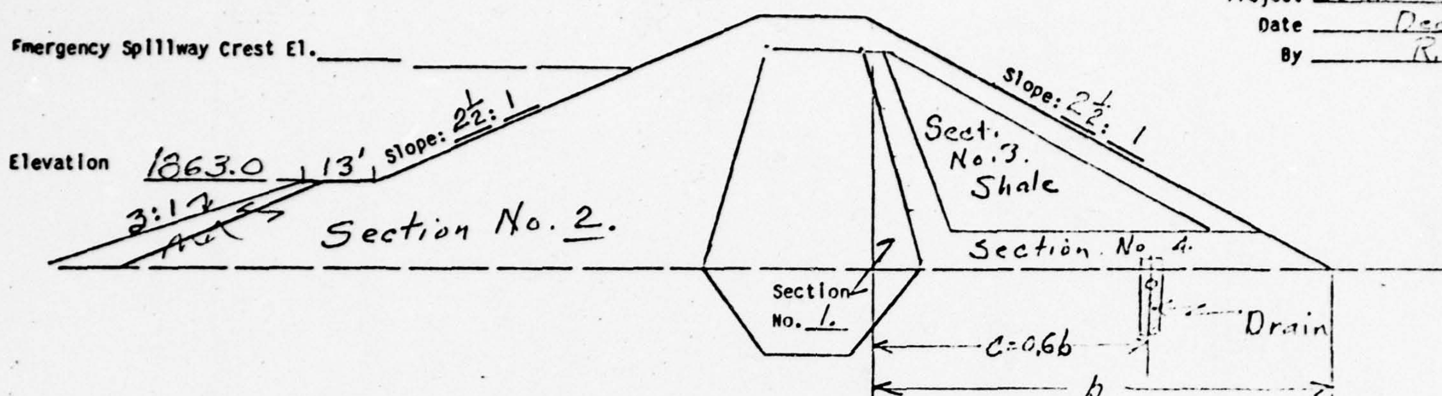
SCS-372
(3/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

RECOMMENDED USE OF EXCAVATED MATERIAL

☐ Formal Zoning Plan ☒ Selective Placement Plan

State Virginia
Project Johns Creek [illegible]
Date Dec. 29, [illegible]
By R.B.K.



TYPICAL EMBANKMENT SECTION

Embankment Section		Source of Fill Material			Lab. Sample No.	Lab Test Standard		Lab. Curve No.	Compaction Requirements Class of Fill		
Sec. No.	Description	Location	Ave. Depth From	Ave. Depth To		Max. Den.	Optm. Moist.		Minimum Density Lbs. per Cu.Ft.	Moisture Range Percent From	Moisture Range Percent To
1.	Backfill + center section	Borrow - (102.1)	1	8	65W 800	102.5	[illegible]	1	1??.5	[illegible]	[illegible]
		" (106.1)	1	7	65W 801	110.5	12.0	[illegible]	[illegible]	[illegible]	[illegible]
		" (124.1)	1	7	65W 804	102.5	[illegible]	5	100.5	[illegible]	[illegible]
		" (126.1)	1	5	65W 805	103.0	18.0	[illegible]	101.0	[illegible]	[illegible]
2.	Upstream + shell section	" (111.1)	1	18	SC-SM 65W 803	112.5	15.0	4	110.0	[illegible]	[illegible]
3.	Shale	E. Spillway (207.1)	1	4	65W 799	118.0	13.0	[illegible]	* [illegible]	[illegible]	[illegible]
4.	SM (Transition section)	Borrow . (108.1)	1	7	65W 802	[illegible]	17.0	3	** 106.0	13	[illegible]
		* Place at minimum max. density [illegible]									
		** Rock correction needed [illegible] material.									

APPENDIX VII

GEOLOGIC REPORT

Form SCS-376A
Sheet 1 of 5

10-5L

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State Virginia County Craig ; — ¼, — ¼, Sec. —, T — R — ; Watershed Johns Creek

Subwatershed Dicks Creek Fund class _____ (FP-2, WP-1, etc.) Site number 4 Site group I Structure class b

Investigated by Mack, T., Geologist (signature and title) Equipment used Case diesel backhoe (Model 530) (Type, size, make, model, etc.) Date 9/64

International TD9 dozer

SITE DATA

Drainage area size 5.63 sq. mi., 3603 acres. Type of structure Earth Fill Purpose Flood Prevention

Direction of valley trend (downstream) SW Maximum height of fill 53.2 feet. Length of fill 880 fe

Estimated volume of compacted fill required 151,505 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	74	10.2	14
Floodwater	705	38.3	46

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Ridge & Valley Province Topography Mountainous Attitude of beds: Dip 44°W Strike N 36°E

Steepness of abutments: Left 16 percent; Right 14 percent. Width of floodplain at centerline of dam 225 fee

General geology of site: The major geologic structure present in the Johns Creek area is a canoe-shaped synclinal fold involving Devonian and Silurian age rocks In the center of this major fold is a double plunging anticline that rests in the middle of the canoe-shaped synclinal fold. Johns Creek Valley is formed by the Clinch-Tuscarora quartzite that forms the ridges present on the flanks of the syncline. The center of Johns Creek Valley is split by Sevenmile Mountain. This mountain has the Oriskany sandstone as the ridge former. This formation occurs in the anticline that is in the center of the larger synclinal fold (Butts 1933).

Johns Creek #4 is mainly underlain by the lower Millboro shale. The lower Millboro formation here is more carbonaceous than the upper Millboro formation that occurs under Sites #2 and #3 on Johns Creek. Here on Johns Creek #4 there occurs a layer of impure anthracite coal in the Millboro black shale. This layer is possibly the oldest bed of coal that has yet been found in the world; for the Millboro shale is of Lower Devonian (lower Erian) age (Butts 1940). Butts recognized the difference

Methods and Procedures -

1. Use is made of the U. S. Department of Agriculture Soil Classification System. The merits of this system as adapted to the use of the engineer are now being realized (PCA Soil Primer).

2. Dry densities were made by use of the Speedy Moisture Tester and the Eley Volumeter. The standard calibration chart was used for the Speedy Moisture Tester. The specific instrument has not been calibrated. Temporary forms were used for the computations.

3. Three seismic surveys and two resistiviter surveys were made on Johns Creek #4. Seismic surveys #1 and #2 were taken to determine the rippability of the shale in the emergency spillway. Seismic survey #3 was taken along the proposed pipe location to determine the character of the rock here. One resistiviter survey was taken in the shale and one resistiviter survey was taken in the anthracite coal present. These were taken to determine the presence of water in these rock types.

4. Permeability tests were conducted. From these results k was determined as set up in temporary forms.

5. The pocket penetrometer was used as a guide to determine the bearing strength of the soil in the foundation.

Centerline of the Dam -

To identify the material present under the centerline of the dam of this proposed location 12 test pits (TP 3 through 14) were dug. These showed that black shale and black shale with anthracite coal underlie most of the foundation. The black shale is fissile. It is composed of fine-grained clay particles. The black shale and anthracite coal is estimated to be approximately 35 percent composed of hydrocarbons. It is fractured into crinkly pieces. Black shiny faces are present on these pieces. TP 14 shows the presence of a limy to slightly limy shale. This shale is estimated to underlie approximately 100 feet of the centerline of the dam at the top of the dam on the left abutment.

Residual, alluvial and colluvial - alluvial soils are present on the centerline of the dam. Residual soil occurs from approximately station 2+00 to 3+30 and from station 4+60 to 5+45 on the centerline of the dam. This soil is shallow.

Below this is a layer of brown silty sand (SM) that ranges in depth up to 1.7 feet. The weathered fractured shale below this layer was dug with a backhoe to a depth of 3.7 feet. Alluvial soil occurs both upstream and downstream from this small hogback of shale. TP 302 and 303 and TP 306 through 308 were dug in this alluvium. These test pits showed that 0.5 feet of topsoil (SM) is present. Below this layer is brown silty sand (SM) that ranges in depth from 4.6 to 0.9 feet. This layer has a dry density that ranges from 86.5 to 95.0 pounds per cubic foot. The moisture present ranges from 5.1 to 11.0 percent. Below this sandy layer is a layer of sandy, silty, cobbly gravel (GM) that has an approximate thickness of 3.5 feet. The "+4" fraction present is composed of subrounded to subangular gravels and cobbles of sandstone. The "+4" fraction percentage increases downstream.

The relief of the shale rockline in the flood plain area on the centerline of the pipe is 2.7 feet. The rockline slopes gently downstream. Relief of the rock on the centerline of the pipe is 5.4 feet. This black shale is fractured. Some silt is present in the fractured planes.

Foundation -

In addition to the test pits placed along the centerline of the dam and along the principal spillway, four additional test pits were dug to investigate the foundation of the dam. These are test pits 401, 402, 501 and 502. These were all in the flood plain area of the foundation. On the proposed toe drain centerline two test pits (TP 501 and 502) were dug. TP 501 had 0.5 feet of topsoil (SM) over 5.3 feet of silty, gravelly sand (SM). The C horizon of this Pope soil is estimated to contain 15 percent "+4" fraction. This area contains less gravel than any other area in the flood plain under the foundation. TP 502 showed that a gravelly Pope soil is present here. This soil is similar to the material described along the pipe trench. The relief of the rockline along the proposed toe drain in the flood plain area is 2.0 feet. At TP 402 there occurs a gravelly Pope soil (GM) that is similar to the soil previously described on the centerline of the dam in the flood plain. Weathered black shale with anthracite is present at a depth of 6.0 feet at TP 402.

Emergency Spillway -

The emergency spillway is located on the right abutment. It transects a small narrow hogback that is underlain by Millboro black fissile shale. Seven test pits (TP 201 through TP 207) were dug to investigate conditions in this cut. This soil has

The left abutment above the flood plain has a Jefferson soil present. This colluvium has moved down from Sevenmile Mountain. Scattered on the ground surface are angular cobbles of Oriskany sandstone. The colluvium has a depth of 3 to 4 feet on the pediment above the flood plain. Further up the slope the Jefferson series is deep. Here there is 10 to 20 feet of yellow brown silty sand (SM). The area covered by this soil type is approximately 9 acres.

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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL SAMPLE LIST
SOIL AND FOUNDATION INVESTIGATIONS

Location Craig County Owner -

Watershed Johns Creek Sub-watershed Dicks Creek Site No. 4

Submitted by Mack, T. Date Oct. 19 6

Sent by truck (carrier) Government B/L No.

Lab. No.	Field Sample No.	Sample Description		Depth		Type of Sample	
		Location	Grid or Station	From	To	Undist.	Dist.
	5-1	C/L Dam	4+20 C/L Dam	1.0	3.9		large
	8-1	C/L Dam	6+65 C/L Dam	1.0	1.6	gallon can	
	9-1	C/L Dam	7+30 C/L Dam	1.9	7.1		small
	10-1	C/L Dam	7+80 C/L Dam	2.6	5.6		small
	13-1	C/L Dam	9+65 C/L Dam	1.0	4.3		small
	102-1	Borrow Area	167'L 3+08 B/L	1.0	8.4		large
	106-1	Borrow Area	33'L 4+10 B/L	1.0	7.0		large
	108-1	Borrow Area	112'L 6+78 B/L	1.0	6.7		large
	111-1	Borrow Area	280'R 4+50 B/L	1.0	17.8		large
	124-1	Borrow Area	156'R 10+65B/L	1.7	7.2		large
	126-1	Borrow Area	10'R 9+53 B/L	1.0	4.9		large
	207-1	E Spillway	2+15 C/L ES	1.0	3.5		large
	307-1	C/L Pipe	2+65 C/L Pipe	1.0	2.9		small
	307-2	C/L Pipe	"	2.9	6.2		large
	501-1	Toe drain	95'R 7+50 C/L Dam	1.0	5.8		small

Original to Soils Laboratory
Copy to E and WP Unit
Distribute other copies as directed by State Conservationist

VA-494-G

Sheet 2 of 9 Sheets

Form SCS 376
Sheet 1 of 2
For In-Service Use Only

USDA-SCS

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State Virginia County Craig Watershed Johns Creek Subwatershed Dicks Creek

Site number 4 Site group I Structure class b Investigated by [signature] (signature and title) Geologist Date 9/64

For In-Service Use Only

INTERPRETATIONS AND CONCLUSIONS

1. The foundation is underlain in the flood plain area by a layer of gravel and gravelly sand. With this condition present the installation of a cut-off trench should be strongly considered. If this measure is taken the cut-off trench should be taken to rock or to the tightly compacted boulder beds on the abutments.

2. The foundation in the seepage drain area has a gravel layer on the right side of the flood plain and a gravelly sand layer on the left side of the flood plain. This condition should be considered in the measures taken to control seepage.

3. Bearing strength of the material in the foundation is considered excellent.

4. No black shale and anthracite should be removed from this bed under the foundation of the dam. A resistiviter survey (R 1) showed some water to be present in this stratum. However, the permeability of this stratum is not considered to be a problem. The dip of this bed would make removal of all material that has water present difficult if not impossible. Also the dip and joint pattern of this bed would tend to minimize the influence of this strata in passing water under the dam. As black shale and anthracite are both resistant to colloidal dispersion or solution the danger of piping is nil.

5. The relief of the black shale rockline along the proposed pipe centerline is slightly irregular. Firm black shale underlies both the proposed riser and bent location.

6. The black shale in the emergency spillway cut is considered to be rippable with heavy equipment to a depth of 33.7 feet. This conclusion is drawn from several factors. One is that the maximum average seismic velocity in this shale is 3,330 ft/sec. The Caterpillar Tractor Company ripper performance chart gives a seismic velocity of 6,000 ft/sec as the upper limit of rippability with a D-9 tractor. Secondly, the Virginia Department of Highways has found the fissile Millboro shale to be rippable to a depth of approximately 30 feet. Road cuts in Millboro shale were removed by a ripper.

7. Sufficient borrow material is available. The Jefferson colluvial series is suggested to be used either as core or shell material. Pope and Leadvale series material is suggested to be used only on the slopes. Question exists whether the clay layer below the Pope series upstream can be obtained. This material has water present in its lower part. In wet weather pans might bog down running over this wet clay layer. The shale removed from the emergency spillway cut should be used on the downstream slopes.

8. Topsoil should be stockpiled and used for topdressing.

Norman Wilson(?) [signature]
State Cons. Eng.

APPENDIX VIII

GENERAL REFERENCES

GENERAL REFERENCES

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